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6. SURFACE & UNDERGROUND

The south and north loading pockets in the headframe were rebuilt and a heated dumptor-loading structure was built in the headframe to eliminate freezing during the winter months. Dumptor stockpiling of the soft hematite ore appears to be working very satisfactorily.

During the year, deep wells #1, #2, #3, #8 and #9 were rebuilt and the pumping equipment overhauled. Pumping has been continued in the surface cave and by using a larger capacity pump, mounted on floats, the water level has been maintained at its lowest possible elevation.

A high-line was constructed to serve the electric shovel for stockpile loading, reducing the length of the trailing cable that is required.

The timber-treating plant has been continued in operation on the 7th level shaft plat. Only timber used in the main-level drifts and important airways is treated at this point before being placed into use. This underground installation makes it very convenient to treat timber at any time during the year.

Surface Pumping

The following table shows a comparison of the volume of water pumped from the various wells at the end of the year with a year ago.

Well No.	G.P.M. Dec. 1954	G.P.M. Dec. 1953
1	69	Down
2	75	Down
3	183	Down
3A	289	402
5	90	130
8	275	275
9	91	45
10	359	345
	1431	1197

The average drop in the water level in the surface material above ledge since pumping started in 1937 to December 22, 1954 is shown in the table below:

Test Hole	Drop 8-25-37 to 12-22-54	Depth Remaining To Ledge
501	79.4	14.1
503	96.3	103.6
504	66.7	82.1
505	92.0	39.1
506	61.2	26.0
509	106.3	83.4
510	34.9	88.7
511	38.4	115.7
512	59.0	102.1
514	27.1	99.8
515	16.7	111.9
517	24.8	87.3
518	50.8	58.8
519	60.4	98.3
522	30.2	84.3
524	18.1	64.7
526	16.4	97.6
527	51.8	23.2
528	10.9	88.6
531	5.2	71.5
533	25.8	106.3

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6. SURFACE (Cont'd)

Surface Pumping (Cont'd)

Test Hole	Drop 8-25-37 to 12-22-54	Depth Remaining To Ledge
534	1.8	95.8
Total	910.2	1742.9
Average	41.4	79.2

Operating Expense for surface drainage amounted to $27,241.00 compared with $14,096.00 in 1953. The cost per ton was $0.08 and $0.04 respectively.

7. UNDERGROUND:

a. Pumping

The bulk of the underground water is being handled by the two 1200 g.p.m. centrifugal pumps located on the 9th and 4th levels. Automatic operation of the pumps has resulted in a reduction in pumping costs despite the increase in wages.

The following table shows a comparison of the mine water pumped over a 5-year period:

Year	4th	6th	7th	8th	9th	Total
1954	71.9	43.5	96.8	553.9	797.0	1574.2
1953	76.1	37.1	77.0	546.2	882.4	1620.9
1952	94.6	27.1	69.2	495.8	971.4	1658.1
1951	107.8	36.3	67.4	431.5	945.8	1588.8
1950	89.2	24.7	79.9	324.6	700.4	1218.2

The following table shows a comparison of the pumping cost per ton for the last six years:

Year	Cost Per Ton
1954	$.46
1953	.55
1952	.65
1951	.493
1950	.423
1949	.423

b. Development

The major development consisted of work on the 10th level after completing the shaft sinking late in 1953. The skip-loading pockets were constructed and following this work new ropes were installed on the skips so hoisting could be done from the 10th level. A concrete-lined loading trench was excavated and constructed north and south of the pockets and the shaft plat was excavated to its full width for a distance of about 250' south of the shaft. On the west side of the plat, two short drifts were advanced to start the development for the sump. Drifting to the ore body had reached a point 800' south of the shaft at the close of the year. This development has been conducted on a one-shift basis for most of the year.

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7. UNDERGROUND (Cont'd)

b. Development (Cont'd)

Chase Lease #24

An average of 5 contracts have continued mining on this Lease during the year. Contract's #30 and #1 have continued stoping in Deposit #79 above the 8th level. Stope development was advanced to the southeast in this area as mining retreated in this direction. Contract #11 was transferred to this area and started cutting out a top timber transfer on the 8th level for a new stope. Contract's #4 and #15 also continued mining the same ore body on the south and west sides respectively above transfers driven on the -300' Sub. Development and mining has proven a larger ore outline than assumed in this area and increased the reserves.

Contract #9 completed stoping in the area at the west end of Deposit #82 near the 9th level elevation and then development was driven to mine the east end of the same ore body by stoping. By the close of the year, development had reached a height of 55' above the 9th level in the latter area and stoping operations started.

Fee Lands

An average of 5 contracts have continued mining on Fee Lands. A small amount of mining was done near the west boundary of the Lease above the 8th level by caving and scram stoping in Deposits #76 and #87-B. Below the 8th level and near the west boundary of the Lease, an area was mined by sub-caving by #7 Contract on the -140' Sub.

At the east end of the ore body, above the 9th level, three contracts have continued mining. Contract #24 has continued stoping and sub-caving in Deposit #84A and Contract #6 has conducted stoping and caving in Deposit #84-B. Development in the latter area proved a small ore body south of the main east-west dike. By the close of the year, mining was completed in the new area above the 9th level. Two separate small areas were mined by sub-caving in Deposit #84-C to complete the work in this deposit above the 9th level. Mining and development has effected a small downward revision in the ore reserves in the above deposits.

Chase Lease #9

There was an average of 9 contracts mining on this Lease throughout the year and the bulk of the production was from this area. Mining has continued to be concentrated in Deposit's #33 and #75-C between the 8th and 9th levels. Sub-caving has been employed almost entirely in these deposits with occasional scram stopes developed where conditions permitted. The block-cave that was developed directly above the 9th level along the east-west dike was completed. Considerable trouble was experienced in this initial block-cave operation due to dilution from a caved area on the north side and also because of the extremely wet conditions.

At the 8th level elevation and below, sub-caving has been continued in Deposit's #87 and #76. The tonnage produced from these two areas was relatively small and mining and development has effected no significant change in the ore reserves.

Sub-level caving has continued to be used mostly in the various mining areas and sub-level stoping to a smaller extent.

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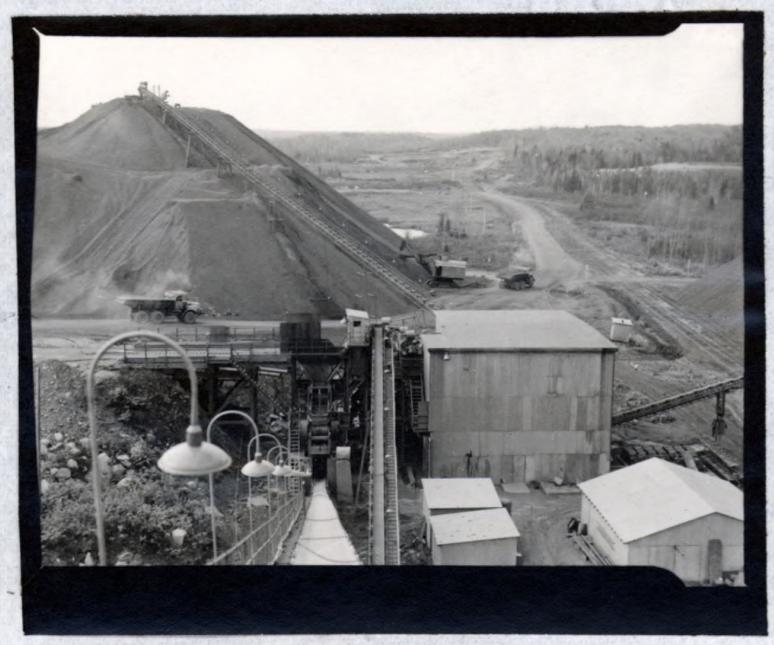

By: H. W. Rembold,
Superintendent.

OHIO MINE - WEST PIT
Looking West from 8400 W. Coordinate, Norwood Lease
October - 1954

OHIO MINE - EAST PIT
Looking East, Portland in foreground and
Webster in background. October -- 1954

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1. GENERAL:

The Ohio Mine production for 1954 was 101,776 tons of concentrate. Cost per ton of concentrate production at the mine was $2.97 whereas total cost per ton on cars was $4.12.

The Webster and Portland leases produced 76,467 and 25,309 tons of concentrate respectively. Shipments amounted to 82,873 tons leaving a carry-over of 18,903 tons of concentrate for 1955 shipments. The remaining ore in stockpile represents 14,290 tons of Webster concentrates and 4,613 tons of Portland concentrates.

The average grade (dried) for the 1954 output was 51.61% iron, 0.421% phos., 9.53% silica and 0.102% sul.

Stripping for the entire mine amounted to 182,341 yards of material. 44,937 yards of stripping were taken from the Webster which completes the program for this lease. 79,393 and 58,011 yards of stripping were moved from the Portland and Norwood leases respectively.

The Ohio Mine was the 1954 winner of the Open Pit Safety Award Flag.

2. PRODUCTION, SHIPMENTS AND INVENTORIES:

a. Operating Schedule:

	No of Days	Shifts Per Day	Hours Per Shift	Total Shifts
Pit Operating - 1954	89	1, 2 & 3	8	170
Pit Operating - 1953	96	1 & 2	8	188
Pit Operating - 1952	70	2	8	140
Mill Operating - 1954	84	1, 2 & 3	8	230
Mill Operating - 1953	111	1 & 3	8	334
Mill Operating - 1952	96	2 & 3	8	291

b. Pit:

	1954 Tons	1953 Tons	1952 Tons
Webster Crude Ore - Pit to Surge Pile	206,739	324,685	201,740
Portland Crude Ore - Pit to Surge Pile	71,398	16,800	- -
Total Crude Ore - Pit to Surge Pile	278,137	341,485	201,740
Average Total Crude Ore Per Day	3,125	3,557	2,882
* Average Total Crude Ore Per Shift	1,636	1,816	1,441
Average Total Crude Ore Per Man Day	52.08	59.79	44.33

* Includes every shift that ore was hauled and therefore does not exclude delays.

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2. PRODUCTION, SHIPMENTS AND INVENTORIES: (Cont'd)

c. Mill:

	1954 Tons	1953 Tons	1952 Tons
Crude Ore - Surge Pile to Mill	276,559	342,390	199,698
Webster Conc. - Pocket in Cars	54,483	118,481	51,166
Webster Conc. - Pocket to Stockpile	21,984	- -	8,341
Portland Conc. - Pocket in Cars	18,623	6,134	- -
Portland Conc. - Pocket to Stockpile	6,686	- -	- -
Total Ohio Concentrates Produced	101,776	124,615	59,507
Average Total Concentrates Per Day	1,212	1,123	620
Average Total Concentrates Per Shift	442	374	204
Average Total Concentrates Per Man Day	20.20	18.42	9.53
Percent of Recovery	36.80	36.39	29.80

d. Shipments: (Gross Tons)

Grade	From Pocket	From Stockpile	Total Year	Remaining Ore In Stock
Webster Concentrates - 1954	54,483	7,694	62,177	14,290
Portland Concentrates - 1954	18,623	2,073	20,696	4,613
Total - 1954	73,106	9,767	82,873	18,903
Webster Concentrates - 1953	118,481	- -	118,481	- -
Portland Concentrates - 1953	6,134	- -	6,134	- -
Total - 1953	124,615	- -	124,615	- -
Webster Concentrates - 1952	51,166	8,341	59,507	- -
Total - 1952	51,166	8,341	59,507	
Grand Total To Date	248,887	18,108	266,995	18,903

e. Stockpile: (Gross Tons)

	1954 Gross Tons	1953 Gross Tons	1952 Gross Tons
In Stock January 1st	-	-	-
Placed in Stockpile	28,670	-	8,341
Total	28,670	-	8,341
Removed from Stockpile During Year	9,767	-	8,341
Stockpile Balance December 31st	18,903	-	- -

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2. PRODUCTION, SHIPMENTS AND INVENTORIES: (Cont'd)

f. Production by Months:

	CRUDE ORE				CONCENTRATES			
	Webster Crude	Portland Crude	Total Crude	Total Crude	Webster Conc	Portland Conc	Total Conc	Total Conc.
	Year 1954			1953	Year 1954			1953
April	-	-	-	4900	-	-	-	880
May	18075	19325	37400	67640	6009	6432	12441	23215
June	57007	-	57007	74640	20920	-	20920	24196
July	63541	-	63541	66540	25639	-	25639	21833
August	50722	24479	75201	58220	17351	8488	25839	23054
September	17394	27594	44988	69545	6548	10389	16937	31437
Total Tons	206739	71398	278137	341485	76467	25309	101776	124615

3. ANALYSIS:

a. Analysis of Pit Crude Ore:

Year 1954				Year 1953			
Grade	Tons	Iron	Silica	Grade	Tons	Iron	Silica
Webster	206,739	41.66	-	Webster	324,685	41.31	28.64
Portland	71,398	41.66	-	Portland	16,800	41.31	28.64
Total	278,137	41.66	-	Total	341,485	41.31	28.64

b. Tonnage and Analysis of Concentrates Produced and Shipped:

OUTPUT YEAR TO DATE 1954:

Grade	From	To	Tons	Iron	Phos	Sil.	Moist	Sul.
Ohio Conc.	Pocket	Stockpile	28,670	50.69	.490	9.56	-	.126
"	Pocket	PI	54,406	51.86	.399	9.43	6.22	.093
"	Stkp.	PI	8,500	50.55	.533	9.81	6.32	.129
Ohio Crude		Prince Mfg. Co.	50	43.45	.337	29.12	7.30	.021
OHIO CONCENTRATE OUTPUT			101,776	51.61	.421	9.53		.102

4. ESTIMATE OF ORE RESERVES:

	*Developed	**Undeveloped	Total
Webster			
Ore Reserves (tons)	0	-	0
Stripping (cu. yds.)	0	-	0
Portland			
Ore Reserves (tons)	15,000	-	15,000
Stripping (cu yds)	43,000	-	43,000
Ohio-Norwood			
Ore Reserves (tons)	346,800	385,000	731,800
Stripping (cu yds)	922,150	1,371,000	2,293,150
Beaufort			
Ore Reserves (tons)	44,200	-	44,200
Stripping (cu yds)	118,850	-	118,850
TOTAL OHIO MINE			
Ore Reserves (tons)	406,000	385,000	791,000
Stripping (cu yds)	1,084,000	1,371,000	2,455,000

* Developed = Proven plus probable ores
** Undeveloped = Prospective Ores

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4. ESTIMATE OF ORE RESERVES: (Cont'd)

b. Developed Ore - Factors Used:

	Cubic Feet Per ton of Crude	Rock Deduction
Portland Concentrates	15	-
Norwood Concentrates	15	-

c. Estimated Analysis:

	Iron	Phos	Sil.	Sul.	Moist
Portland Conc. (Dried)	52.00	.400	10.00	.150	-
Portland Conc. (Natural)	48.36	.372	9.30	.140	7.00
Norwood Conc. (Dried)	51.40	.160	8.00	.100	-
Norwood Conc. (Natural)	47.80	.156	7.44	.093	7.00

5. LABOR AND WAGES:

a. Comments:

The labor force at the Ohio Mine was held at the very minimum requirements for the entire 1954 production season, effecting a better ton per man rating and a lower average number of men employed.

The one formal grievance made by the Ohio Mine Union Local was dropped before reaching the 5th step. The grievance was made against the mine selection of a heavy density operator based on ability.

Mr. L. R. Drake, who serves as the Tilden Mine foreman during its operating seasons, was transferred to the Ohio Mine as the afternoon shift supervisor.

b. Report of Vacations Paid:

	No Men	Total Hours	Total Amount	Avg. Rate Per Hour	Year
One Week - 40 Hrs. - Vacation Paid	57	2,280	$4727.10	$2.073	1954
One Week - 48 Hrs. - Vacation Paid	56	2,688	$5,694.84	$2.118	1953
One Week - 48 Hrs. - Vacation Paid	50	2,400	$4,464.84	$1.860	1952

c. Comparative Statement of Production and Wages: (Operating - Ore)

	Year 1954	Year 1953	Year 1952
Production - Concentrates (Long Tons)	101,776	124,615	59,507
Number of Days Operated	84	111	96
Number of Shifts Operated	230	334	291
Average Daily Product (Long Tons)	1,212	1,123	620
Average Product Per Shift (Long Tons)	442	374	204
Average Number of Men Employed	54¾	61	61
Product Per Man Per Day (Total Men)	22.14	18.41	9.53
Average Wages Per Man Per Day	$18.80	$17.96	$15.76
Total Amt Pd for Labor during Optg.	$86,405.74	$121,587.24	$92,270.92
Labor Cost Per Ton	$0.849	$0.976	$1.551

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5. LABOR AND WAGES:

d. Report of Men Hired, Transferred, and Separated:

Month	Start Of Mo.	Hires	Returns From Temp. Lay-Off	Total	Final Separation	Temp. & Perm. Trans.	End Of Month
January	54	-	-	54	31	5	18
February	18	-	-	18	2	1	15
March	15	-	1	16	-	-	16
April	16	7	38	61	-	-	61
May	61	1	2	64	4	-	60
June	60	1	-	61	1	1	59
July	59	2	-	61	1	-	60
August	60	-	-	60	-	-	60
September	60	-	-	60	14	-	46
October	46	-	-	46	38	8	-
November	-	-	-	-	-	-	-
December	-	-	-	-	-	-	-
Total	54	11	41	106	91	15	0

The above table includes only hourly rate employees and mine payroll salaried employees.

e. Annual Statement of Labor:

	Statistical Men	Hours	Amount	Average Rate
MINE PAYROLL:				
Hourly Employees:				
Straight Time	41½	63689½	$130,155.76	$2.044
Overtime	¾	1258½	1,384.41	1.100
Shift Differential - Aft.	11½	17533	1,058.22	.060
Shift Differential - Night	6	9361½	846.19	.090
Holiday Allowance	1	1760	3,544.04	2.014
Sub Total	41½	63689½	$136,988.62	$2.151
Vacation Pay Accrual	-	-	4,729.10	-
Total Hourly Employees	41½	63689½	$141,717.72	$2.225
Salaried Employees:				
Mine Payroll	1½	2393	6,258.05	2.615
Total Mine Payroll	43	66082½	$147,975.77	$2.239
General Payroll:				
Salaried: Straight Time	2¾	4433	11,530.34	2.601
Overtime	-	22	19.67	.894
Labor from other Mines	2	2954	7,536.83	2.551
GRAND TOTAL LABOR	47¾	73469½	$167,062.61	$2.274
Distributed as follows:				
Operating Mine	23¾	36776	$ 86,405.74	$2.350
Winter and Idle	7	10701	24,520.68	2.291
Stripping	11½	17650½	37,871.96	2.146
Other Mines	2½	3749	9,131.94	2.436
Other Accounts	3	4593	9,132.29	1.988
GRAND TOTAL AS ABOVE:	47¾	73469½	$167,062.61	$2.274

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5. LABOR AND WAGES: (Cont'd)

e. Annual Statement of Labor: (Cont'd)

AVERAGE NUMBER OF MEN

	Hourly	Salaried	Payroll	Total	Mine Average Hourly Job Rate
Average Year	40½	1	2	43	10½

	Days Mine Operated	Tons Ore	Cubic Yds Stripping	Units Per Man Day	Labor Cost Per Unit
Pit Crude Ore	89	278,137	-	-	-
Mill Concentrating	84	101,776	-	22.17	0.849
Stripping	72	-	182,341	82.66	0.208
Days Total Year	192				

6. GENERAL SURFACE:

a. Buildings and Repairs:

There was no new construction for 1954. Repairs and changes in the mill, office and shop buildings were very minor.

b. Roads, Transmission Lines, Etc:

The power transmission lines to the west pit will require some changes and additions to effect a more efficient pit operation during production seasons.

Haul roads from the west pit were surfaced with the coarse heavy media rejects during the two week stripping program in the Norwood lease following the 1954 production season.

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7. OPEN PIT:

a. Stripping Operations - Webster Pit (E&A CC-430):

Truck and Shovel

	No. Days	Shifts Per Day	Total Shifts
Year 1954	0	0	0
Year 1953	34	1, 2 & 3	74
Year 1952	55	1, 2 & 3	117
Program To Date	143	1, 2 & 3	303

Production: (Cubic Yards)

	Estimated
Total Scheduled Program E&A CC-430: Estimate (12-54) To develop all Proven and Probable Reserves	168,926 cu yds Surface 160,340 cu yds Rock

	1954 Year	1953 Year	1952 Year	Completed To Date
Actual Stripping				
Surface	-	-	55,725	168,056
Rock	-	85,901	87,270	173,171
Total	-	85,901	142,995	331,227
Average Stripping Per Shift				
Surface	-	-	1,476	1,167
Rock	-	1,161	746	1,085
Total	-	1,161	1,222	1,126
Estimated Cost Per Cu Yd				
Surface	$0.450	$0.450	$0.450	$0.450
Rock	$0.600	$0.600	$0.600	$0.600
Actual Cost Per Cu Yd				
Surface	-	-	$0.455	$0.476
Rock	-	$0.595	$0.385	$0.498
Total	-	$0.595	$0.413	$0.491

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7. OPEN PIT: (Cont'd)
b. Stripping Operations - Portland Pit (E&A CC-430):

Truck and Shovel

	No. Days	Shifts Per Day	Total Shifts
Year 1954	18	3	51
Year 1953	29	1, 2 & 3	79
Year 1952	1	2	2
Program to Date	48	1, 2 & 3	132

Production: (Cubic Yards)

	Estimated
Total Scheduled Program	
E&A CC-430:	114,000cu yds Surface
Estimate (12-54)	136,000 cu yds Rock
To Develop all Proven and Probable Reserves	

	1954 Year	1953 Year	1952 Year	Completed to Date
Actual Stripping				
Surface	61,545	86,679	2,400	150,624
Rock	7,435	20,310	-	27,745
Total	68,980	106,989	2,400	178,369
Average Stripping Per Shift				
Surface	1,368	1,125	1,200	1,301
Rock	1,239	1,256	-	1,380
Total	1,207	1,320	1,200	1,351
Estimated Cost Per Cu Yd				
Surface	$.450	$.450	$.450	$.450
Rock	$.600	$.600	$.600	$.600
Actual Cost Per Cu Yd				
Surface	$.410	$.404	$.696	$.411
Rock	$.762	$.466	$.000	$.546
Total	$.449	$.415	$.696	$.432

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7. OPEN PIT: (Cont'd)

c. Stripping Operations - Norwood-Beaufort Pit: (E&A CC-430):

Truck and Shovel

	No. Days	Shifts Per Day	Total Shifts
Year 1954	-	-	-
Year 1953	70	2 & 3	202
Year 1952	83	1, 2 & 3	234
Program to Date	153	1, 2 & 3	436

Production: (Cubic Yards)

	Estimated
Total Scheduled Program	
E&A CC-430	1,430,300 cu yds Rock
Estimate (12-54)	1,397,498 cu yds Surface
To develop all proven and probable reserves	

	1954 Year	1953 Year	1952 Year	Completed To Date
Actual Stripping				
Contract - (Norwood)	-	~~112,326~~	109,058	136,308 *
Surface - (CCI Norwood)	-	112,326	272,730	385,056
Rock - (CCI Norwood)	-	68,199	-	68,199
Surface - (CCI Beaufort)	-	58,650	20,460	79,110
Total	-	239,175	402,284	658,875
Average Stripping Per Shift				
Surface	-	1,196	1,253	1,140
Rock	-	1,259	-	1,261
Total	-	1,184	1,253	1,174
Estimated Cost Per Cu Yd				
Surface	$.450	$.450	$.450	$.450
Rock	$.600	$.600	$.600	$.600
Actual Cost Per Cu Yd				
Surface	-	$.432	$.323	$.511
Rock	-	$.391	$.000	$.363
Total	-	$.420	$.323	$.379

* 4,678 Cu Yds - LeBreque & Pierce for County Roads, chgd to road construction.
5,120 Cu Yds - Jos Hamel - Gravel Roads and Area - chgd to road construction.
102,476 Cu Yds - Lindberg & Sons - Contract
24,034 Cu Yds - D.S.S. & A. Ry. for railroad spur.
136,308 Cu Yds - Total Contract

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7. OPEN PIT: (Cont'd)

d. Stripping Operations: Portland Mine (E&A CC-631):

Truck and Shovel	No. Days	Shifts Per Day	Total Shifts
Year 1954	12	1 & 2	14
Program to Date	12	1 & 2	14

Production: (Cubid Yards)		Estimated
Total Scheduled Program E&A CC-631:		9,365 cu yds Surface 550 cu yds Rock
	Year	
Actual Stripping:	1954	Program to Date
Rock	10,413	10,413
Average Stripping Per Shift:		
Rock	744	744
Estimated Cost Per Cu Yd		
Rock	$.52	$.52
Surface	$.45	$.45
Actual Cost Per Cu Yd		
Rock	$.584	$.584

e. Stripping Operations: Webster Mine (E&A CC-631):

Truck and Shovel	No. Days	Shifts Per Day	Total Shifts
Year 1954	28	1 & 2	45
Program to Date	28	1 & 2	45

Production: (Cubic Yards)		Estimated
Total Scheduled Program E&A CC-631:		21,850 cu yds Surface 65,450 cu yds Rock
	Year	
Actual Stripping	1954	Program to Date
Rock	44,937	44,937
Average Stripping Per Shift		
Rock	999	999
Estimated Cost Per Cu Yd		
Rock	$.52	$.52
Surface	$.45	$.45
Actual Cost Per Cu Yd		
Rock	$.529	$.529

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7. OPEN PIT: (Cont'd)

f. Stripping Operations: Norwood Lease (E&A CC-648)

Truck and Shovel	No Days	Shifts Per Day	Total Shifts
Year 1954	15	1, 2 & 3	39
Program to Date	15	1, 2 & 3	39

Production: (Cubic Yards)
Total Scheduled Program — Estimated
E&A CC-648: 1,852 cu yds Surface
51,681 cu yds Rock

	Year 1954	Program to Date
Actual Stripping		
Surface	6,120	6,120
Rock	51,891	51,891
Total	58,011	58,011
Average Stripping Per Shift		
Rock & Surface	1,289	1,289
Estimated Cost Per Cubic Yard		
Surface	$.45	$.45
Rock	$.50	$.50
Actual Cost Per Cubic Yard		
Rock & Surface	$.445	$.445

g. Detail of Stripping:
Webster Lease: (East Pit)

The bulk of the 44,937 cubic yards of Webster stripping represented hanging wall material. The hanging wall material had to be removed prior to the sinking cuts in ore.

Cost per yard for the 1954 Webster stripping was $0.529. The $0.529 per yard cost was high due to numerous shovel and churn drill moves. The end of the season requirements called for small amounts of stripping necessary to keep the available crude ore reserve only a week ahead of mill requirements.

The use of a second shovel, the old Marion shovel, facilitated the problem of keeping the mill supplied with crude ore while pit operations were devoted to cleaning up the last of the Webster crude ore.

Portland Lease: (East Pit)

Portland stripping for 1954 totaled 79,393 cubic yards. During January 61,545 cubic yards of overburden were removed from an area between the two old Portland pits and an area along the hanging side of the formation just south of the old East Portland pit workings. During the operating months 17,848 cubic yards of lean hanging wall material was moved to realize additional depth in the pit and additional width to facilitate shovel and truck movements.

Combining the surface and rock stripping expenditures, the cost per cubic yard for the 79,393 cubic yards of material moved was $0.465.

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7. OPEN PIT: (Cont'd)

g. Detail of Stripping: (Cont'd)
Norwood Lease: (West Pit)

A three week stripping program in the Norwood lease resulted in the removal of 6,120 cubic yards of surface and 51,891 cubic yards of rock. Stripping ceased on October 15th.

Cost per cubic yard of moving the 58,011 cubic yards of stripping was $0.445.

The bulk of the Norwood stripping was taken from the hanging wall side of the ore body between the 8200W and 9000W coordinates. The old mined out areas presented a problem from the standpoint of possible cave-ins and the possibility of flooding out the equipment if blasting fractured the hanging wall side of stope and drift openings. The mining plan called for a sinking cut on the hanging wall side of the ore body. By means of information taken from the old Beaufort maps several well placed churn drill holes were blasted to effect the flow of water from the upper mine workings to the sinking cut. Pumping water from the open cut will be much more satisfactory than lowering pumping equipment into the old abandoned underground mine workings.

h. Detail of Stripping Costs:

Norwood-Beaufort Pit (E&A CC-430:)

	Year 1954	Year 1953	Total To Date
Cubic Yards Production:			
Beaufort Surface	-	58,650	79,110
Norwood Surface	-	112,326	511,566
Norwood Rock	-	68,199	68,199
Total	-	239,175	658,875
Cost of Stripping Per Yard: (Surface and Rock)			
Pit Operating	-	$0.290	$0.300
General Mine Expense	-	0.065	0.026
Cost of Production	-	$0.355	$0.326
Depreciation	-	0.065	0.053
Total Cost of Production	-	$0.420	$0.379
E&A CC-430: Amount Expenditure:			
Surface	-	$66,903.12	$189,401.05
Rock	$7,424.94	17,918.59	25,343.53
Total Surface & Rock	$7,424.94	$84,821.71	$214,744.58
Depreciation	827.75	15,765.35	35,026.48
Total Expenditure	$8,252.69	$100,587.06	$249,771.06
Cost Per Yard: (Including Depreciation)			
Cost of Surface	-	$0.432	$0.511
Cost of Rock	-	$0.391	$0.363
Total Cost of Production	-	$0.420	$0.379

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7. OPEN PIT: (Cont'd)
g. Detail of Stripping: (Cont'd)
h. Detail of Stripping Costs: (Cont'd)

	Year 1954	Year 1953	Total To Date
Portland Pit (E&A CC-430:)			
Cubic Yards Production:			
Surface	61,545	86,679	150,624
Rock	7,435	20,310	27,745
Total	68,980	106,989	178,369
Cost of Stripping Per Yard: (Surface & Rock)			
Pit Operating	$0.354	$0.296	$0.323
General Mine Expense	0.043	0.079	0.065
Cost of Production	$0.397	$0.376	$0.388
Depreciation	0.052	0.039	0.044
Total Cost of Production	$0.449	$0.415	$0.432
E&A CC-430: Amount Expenditure:			
Surface	$23457.60	$31877.70	$56866.10
Rock	3843.69	8384.32	12228.01
Total Surface and Rock	$27301.29	$40262.02	$69094.11
Depreciation	3549.17	4238.30	7931.23
Total Expenditure	$30850.46	$44500.34	$77025.34
Cost Per Yard: (Including Depreciation)			
Total Cost of Production	$0.449	$0.415	$0.432
Webster Pit (E&A CC-430:)			
Cubic Yards Production:			
Surface	-	-	168,056
Rock	-	85,901	173,171
Total	-	85,901	341,227
Cost of Stripping Per Yard: (Surface & Rock)			
Pit Operating	-	$0.481	$0.402
General Mine Expense	-	0.067	0.023
Cost of Production	-	$0.548	$0.425
Depreciation	-	0.047	0.066
Total Cost of Production	-	$0.595	$0.491
E&A CC-430: Amount Expenditure:			
Surface	-	-	$70,697.91
Rock	$2,894.15	$47,060.31	74,731.79
Total Surface & Rock	$2,894.15	$47,060.31	$145,429.70
Depreciation	-	4,085.93	22,155.09
Total Expenditure	$2,894.15	$51,146.24	$167,584.79
Cost Per Yard: (Including Depreciation)			
Total Cost of Production	$0.00	$0.595	$0.491

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7. OPEN PIT: (Cont'd)

h. Detail of Stripping Costs: (Cont'd)

	Year 1954	Program to Date
Portland Mine - (E&A CC-631:)		
Cubic Yards of Production	10,413	10,413
Cost of Stripping Per Cubic Yard	$0.584	$0.584
E&A CC-631: Amount Expenditure	$6086.39	$6086.39
Webster Mine: E&A CC-631:		
Cubic Yards of Production	44,937	44,937
Cost of Stripping Per Cubic Yard	$0.529	$0.529
E&A CC-631: Amount Expenditure	$23780.52	$23,780.52
Norwood Lease: E&A CC-648:		
Cubic Yards Production	58,011	58,011
Cost of Stripping per Cubic Yard	$0.445	$0.445
E&A CC-648: Amount Expenditure	$25811.62	$25811.62

E&A CC-430: Stripping Expenditure to Date:

	Norwood Beaufort	Webster	Portland	Grand Total To Date
Total Expenditure	$249,771.06	$167,583.19	$77,025.34	$494,379.59

E&A CC-631: Stripping Expenditure to Date:

	Portland Mine	Webster Mine	Grand Total To Date
Total Expenditure	$6,086.39	$23,780.52	$29,866.91

E&A CC-648: Stripping Expenditure To Date:

	Norwood Lease	Grand Total To Date
Total Expenditure	$25,811.62	$25,811.62

TOTAL STRIPPING YARDAGE TO DECEMBER 31, 1954

Lease	E&A CC-430	E&A CC-631	E&A CC-648	Grand Total Cubic Yards
Webster	341,227	44,937	-	386,164
Portland	178,369	10,413	-	188,782
Norwood	579,765	-	58,011	637,776
Beauford	79,110	-	-	79,110
Total Yards	1178,471	55,350	58,011	1,291,832

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7. OPEN PIT: (Cont'd)

i. Detail of Open Pit Mining:

Pit operations were started on April 29th and continued through September 23rd. 276,559 tons of crude ore were placed on the surge pile during the 1954 production season. Webster crude ore production was 206,739 tons and Portland crude ore production was 69,820 tons. No crude ore was mined from the West pit.

Total crude ore mined from the Webster lease amounted to 728,104 tons. The 1954 production depleted the Webster lease of its crude ore reserves.

The Ohio Plant was designed with the hopes that a one shift pit operation would carry a three shift mill operation. However, as was discovered in 1952 and proven in following years the pit production on a one shift basis would not carry the mill for its 24 hour production schedule.

The 1954 tonnage indicated above represents several shallow cuts the length of the East pit. The benches averaged 10 - 15 feet in height. The shallow benches were necessary in cleaning the crude ore off the footwall and it was necessary to make shallow sinking cuts due to the great volumes of water encountered in the mining operations. The width of the enriched material dropped considerably from the 90 - 110 foot widths encountered in the 1952 and 1953 production seasons. The ore body pinched out in areas in the Webster lease to widths of 50 feet and less. It was found that in depth the ore did not necessarily react the same in the mill as the crude ore immediately above it. The mill was seriously handicapped by the mining of the crude ore in shallow benches.

Ground water encountered in the East pit was a serious problem during the 1954 production season. The numerous small flows coming into the pit area along the footwall side prevented the concentration of water into one common sump area.

The following tables outline the details of truck haulage, primary blasting and churn drilling for 1954:

		TRUCK HAULAGE			
Month	Shifts	Crude Ore	Rock	Surface	Total
Webster Pit:					
May	13½	723	210	-	933
June	42	2325	801	-	3126
July	62	2721	1137	-	3858
August	43	2197	463	-	2660
September	11	734	-	-	734
Total Loads		8700	2611	-	11311
Number of Shifts	171½				
Avg Loads Per Shift					66
Portland Pit:					
January	45	-	-	4103	4103
April	6	-	476	-	476
May	14	773	248	-	1021
August	25	1041	348	-	1389
September	18	1178	-	-	1178
Total Loads		2992	1072	4103	8167
Number of Shifts	108				
Avg Loads Per Shift					76

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7. OPEN PIT: (Cont'd)

i. Detail of Open Pit Mining: (Cont'd)

Month	Shifts	TRUCK HAULAGE Crude Ore	Rock	Surface	Total
Norwood-Beaufort Pit:					
September	13	-	1230	-	1230
October	26	-	2560	-	2560
Total Loads		-	3790	-	3790
Number of Shifts	39				
Avg Loads Per Shift					97
Concentrates to Stockpile					
June	7				131
July	27				359
August	23				345
September	13				181
TOTALS	70				1016

Date	No. Of Holes	PRIMARY BLASTING Tons Ore Broken	Tons Rock Broken	Tons of Mat. Broken Per Lb of Powder	Powder Cost Per/ton Mat.
Webster Pit:					
4-29-54	12	6,650	2,100	3.50	$0.053
5-12-54	34	23,500	7,573	3.79	0.050
6- 1-54	70	65,700	21,900	3.65	0.056
6-25-54	74	34,000	11,360	3.60	0.056
7-19-54	55	45,120	22,560	3.60	0.048
8- 2-54	77	21,600	40,000	3.20	0.055
8-20-54	4	3,000	3,125	3.50	0.055
9-26-54	15	-	3,000	3.50	0.055
9- 1-54	15	3,000	-	3.00	0.069
9-20-54	24	800	1,600	3.00	0.069
Totals	380	203,370	113,218		
Portland Pit:					
4-23-54	28	8,500	25,250	3.50	$0.053
4-29-54	35	17,850	10,500	3.50	0.053
5-18-54	18	4,300	500	4.80	0.050
8-11-54	41	13,060	39,300	3.40	0.055
8-13-54	5	6,125	-	3.50	0.055
8-24-54	6	7,000	-	3.50	0.055
8-27-54	34	12,200	32,940	3.20	0.055
9- 9-54	25	15,900	15,000	3.00	0.069
9-16-54	6	2,500	4,050	3.00	0.069
Totals	198	87,435	127,540		
Norwood Lease:					
9-27-54	36	-	8,625	3.00	$0.069
10-4-54	43	750	27,050	1.84	0.106
10-7-54	9	-	11,160	1.80	0.106
10-19-54	12	825	8,000	1.68	0.106
Totals	100	1,575	54,835		
GRAND TOTAL	678	292,380	295,593		

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7. OPEN PIT: (Cont'd)

i. Detail of Open Pit Mining: (Cont'd)

TOTAL POWDER USED (PRIMARY BLASTS)

Month	Lb. EP #158	Lb. EP #152	Lb. EP #146	XC-45 Boosters	Plastic Primacord	Plain Primacord	#17 MS Connectors
April	350	19,900		135	2,500	2,500	
May		9,200		93	2,000	1,500	50
June		25,000	11,900	225	7,200	5,500	12
July			18,800	100	2,500	2,000	
August			56,350	320	5,570	4,450	100
September			20,000	104	3,000	4,000	
October			29,500	125	3,000	3,000	
Totals	350	54,100	136,550	1,102	25,770	22,950	162
Price Per Unit	$20c	$17.65c	$16.40c	$35c	$37m	$32m	$40.50c
Total Cost	$700.	$9548.65	$22394.20	$385.70	$953.49	$734.40	$65.61

CHURN DRILLING

Month	Shifts	Holes Drilled	Footage Drilled	Avg Depth Per Hole	Ft Per Shift	Bits Used	Feet Per Bit	Cost Per Foot
Webster Pit								
April	12	18	395	22	33	5	79	$1.253
May	63	110	3090	28	49	31	100	0.707
June	50	104	2153	20.7	43.2	23	93.6	0.790
July	68	114	2859	25	47.2	27	106	0.783
August	16	34	581	17	36.3	5	116.2	1.691
September	14¼	30	408	13.6	28.6	5	82	1.420
Totals	223¼	410	9486	22.9	42.49	96	98.8	
Portland Pit:								
April	42	68	1467	21.6	35	20	73	$1.234
May	5	17	238	14	48	2	119	1.182
August	76	125	3258	26	42.9	40	81.4	0.943
September	26¾	45	1181	26.2	44.1	17	65.5	0.812
Totals	149¾	255	6144	24.1	41	79	77.8	
Norwood Pit:								
September	51	102	2255	21.1	44.2	13	173.7	$0.818
October	37	55	1376	25	39	12	115	1.411
Totals	88	157	3631	23.1	41.3	25	145.2	$1.042
Grand Totals	461	822	19261	23.3	41.8	200	96.3	

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8. BENEFICIATION:

a. 1954 Plant Production and Analyses:

	Tons	% Wt.	Crude	% Fe	% P.	% SiO_2	% S.
Pit Crude	278,137			41.66			
Plant Head	276,559			41.70			
H.M. Conc.	74,810	38.43	27.05	52.58		8.88	
H.M. Reject	119,859	61.57	43.34	32.31			
H.M. Feed	194,669	100.00	70.39	40.10			
Fines Conc.	26,966	39.28	9.75	50.51		10.69	
Fines Tailing	41,678	60.72	15,07	42.65			
Fines Feed	68,644	100.00	24.82	45.74			
Hydroscillator O.F.	13,246	-	4.79	44.96			
Calculated Plant Head			100.00	41.73			

Concentrates

H.M. Concentrate	74,810	73.50	27.05	52.58		8.88	
Classifier Concentrate	26,966	26.50	9.75	50.51		10.69	
Calculated Total Concentrate (by plant analyses)	101,776	100.00	36.80	52.03		9.36	

	Tons	% Wt.	% Moist	% Fe	% P.	% Sil	% Sul
Total Concentrate Shipped from Pocket	73,106	71.82	6.22	51.86	.399	9.43	.093
Total Concentrate Shipped from stockpile	9,767	9.60	6.32	50.55	.533	9.81	.129
Balance in stockpile	18,903	18.58	-	50.72	.472	9.47	.123
Total Concentrates* (by car analyses)	101,776	100.00	-	51.61	.421	9.53	.102

* 76,467 tons Webster Lease
27,309 tons portland lease

b. Plant Operations:

The Ohio Mill operated from April 29th through September 23rd. The plant produced 101,776 tons of concentrate from 276,559 tons of crude for a recovery of 36.80%. The recovery for the 1954 Season was roughly 1.2% higher than for the 1953 Season. The actual recovery could not be accurately computed as approximately 18,000 tons of concentrates remained in stockpile at the end of the season and the exact amount of overrun cannot be determined until the stockpile has been shipped out and the weights reported.

The dried analyses of the product shipped during the year based on cartop samples, averaged 51.61% Fe, .421% Phos., 9.53% SiO_2 and .102% Sulphur. Moisture of the concentrates shipped during the year averaged 6.23% resulting in an average natural iron content of 48.49%.

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8. BENEFICIATION: (Cont'd)

c. Plant Delays:

Source of Delay	Hours	Percent Of Total Delays	Percent of 2117 Working Hours
Initial Startup of Plant	10.08	2.30	.48
Startup of Plant after Weekends	7.25	1.65	.34
Symons Crusher	12.93	2.95	.61
Conveyors	27.04	6.17	1.28
No. 1 Conveyor	137.00	31.27	6.47
Stacker Conveyor No. 9	14.75	3.37	.70
5' x 12' Ripl Flo Screen	13.83	3.16	.65
5' x 12' Low Head Screen	5.65	1.29	.27
6' x 12' Low Head Drain Screen	4.00	.91	.19
6' x 12' Low Head Wash Screen	2.80	.64	.13
Feeding from Surge Pile & Tunnel Feeder	8.09	1.85	.38
Building up Specific Gravity of Media	7.42	1.69	.35
Heavy Media Section	3.73	.85	.18
Spiral Section	1.23	.28	.06
3' x 10' Dewatering Screen	7.96	1.82	.38
Chutes & Boxes	12.97	2.96	.61
Pumps	11.31	2.58	.53
Sump Pump	7.16	1.63	.34
Magnetic Separators	4.10	.94	.19
Power Failures	9.92	2.26	.47
Cold Weather	122.33	27.92	5.78
Compressor	3.50	.80	.16
Plant Shutdown	3.08	.71	.14
Totals	438.13	100.00	20.69

Operating Time 1954 Season - 79.31%
Operating time 1954 season discounting time lost in April-May for repair of Conveyor No. 1, and time lost due to cold weather - 90.38%.

d. Pit to Surge Pile - Time Distribution

	Hours	Percent Of Total Delays	Percent of 13.60 Working Hours
Blasting in Pit	21.33	11.01	1.57
Shovel:			
Greasing	19.84	10.24	1.46
Moving in Pit	38.33	19.78	2.82
Repairing - Changing Teeth	14.50	7.48	1.07
Primary Hopper Plugging	18.50	9.55	1.36
Mn Feeder (Shearing Pins)	12.84	6.63	.94
Jaw Crusher	43.65	22.53	3.21
Scalping Screen	9.00	4.65	.66
Conveyor No. 1	6.25	3.23	.46
Power Failures	9.50	4.90	.70
Total Delays	193.74	100.00	14.25
Hauling Rock	79.50		5.84
Hauling Ore	1086.76		79.91
Total Time Distribution	1360.00		100.00

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8. BENEFICIATION: (Cont'd)

e. Hourly Operating Rates:

	Tons	Gross Hours Operation	Net Hours Operation	LTPH Gross	LTPH Net
Pit Crude to Stockpile:					
1954 Season	278,137	1360.00	1087.00	204.51	255.88
1953 Season	348,831	1920.00	1182.00	181.68	295.12
1952 Season	201,740	1125.00	938.42	179.32	214.98
Stockpile to Plant:					
1954 Season	276,559	2117.00	1679.00	130.64	164.72
1953 Season	349,751	2728.00	2276.92	128.21	153.61
1952 Season	199,698	2299.50	1655.67	86.84	120.61
Heavy Media Feed:					
1954 Season	194,669	2117.00	1679.00	91.95	115.94
1953 Season	252,824	2728.00	2276.92	92.68	111.04
1952 Season	128,349	2299.50	1655.67	55.82	77.52
Fines Feed:					
1954 Season	68,644	2117.00	1679.00	32.43	40.88
1953 Season	81,086	2728.00	2236.09	30.01	36.26
1952 Season	61,051	2299.00	1567.62	26.55	38.95
Concentrates:					
1954 Season	101,776	2117.00	1679.00	48.08	60.62
1953 Season	124,615	2728.00	2276.92	45.64	54.73
1952 Season	59,507	2299.50	-	25.88	-

Plant Operating Time:
1954 Season 79.31 -(90.37% Discounting 259.33 hours lost in April)
1953 Season 83.46% and May due to cold weather and breakdown of Conv #1
1952 Season 72.04%

f. Monthly Hourly Operating Rates:

	Pit Crude to Stockpile	Stockpile To Plant	Heavy Media Feed	Fines Feed	Concentrates
		Tons Per Hour Gross			
April-May	212.50	71.97	46.67	18.93	23.93
June	197.94	145.04	109.60	30.87	52.30
July	209.02	144.62	111.71	29.47	58.27
August	208.89	158.88	103.58	44.69	58.07
September	193.91	149.96	100.38	43.57	54.28
		Tons Per Hour Net			
April-May	296.83	169.33	109.81	44.55	56.29
June	250.04	157.65	119.14	33.56	56.85
July	246.28	160.68	124.12	32.74	64.74
August	259.31	171.60	111.87	48.27	62.72
September	243.18	165.91	111.05	48.21	60.06

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8. BENEFICIATION: (Cont'd)

g. Surge Pile, Concentrate Stockpile, and Coarse Reject Pile Balance:

	Tons	% Fe
Crude Ore on Surge Pile 7:00 A.M., April 29, 1954	1,122	
Crude Ore to Surge Pile from Pit during 1954	278,137	41.66
Crude Ore from surge Pile to Plant 1954 Season	276,559	41.70
Crude Ore on Surge Pile 7:00 A.M., September 24th	2,700 *	

* All Portland Lease

	Tons	% Fe	% SiO_2
Concentrates Stocked during 1954 Season	28,670	50.55	9.59
Concentrates Shipped from Stockpile during 1954	9,767	50.55	9.81
Stockpile Balance, December 1, 1954	18,903	50.72	9.47

	Tons	% Fe
Heavy Media Reject Pile 7:00 A.M., April 29, 1954	245,287	33.69
Heavy Media Rejects to Pile during 1954 Season	119,859	32.31
H.M. Reject Pile 7:00 A.M., September 24, 1954	365,146	33.24
Less 9,000 tons which caved into old Ohio Undg. Wkgs.	9,000	
Balance	356,146	33.24

	Barrels	Pounds
Ferrosilicon on Hand 7:00 A.M. April 28, 1954	424	214,730
Ferrosilicon received during 1954 Season	-	-
Ferrosilicon dumped during 1954 Season	264	133,646
Ferrosilicon on Hand 7:00 A.M., September 24, 1954	(156*	78,936
Ferrosilicon (in Barrels)	(3**	1,611
Ferrosilicon sold to North Range Mining Company	1**	537
Ferrosilicon on Hand 7:00 A.M., September 24, 1954 (in plant)		35,486

* 65 Mesh
** 100 Mesh

h. Monthly Media Loss: (1954 Season)

	lb. FeSi Dumped	Tons H.M. Feed	Tons H.M. Conc.	FeSi Loss lb/ton H.M. Feed	FeSi Loss lb/ton H.M. Conc.	Percent Recovery
April-May	20,271	24,268	8,353	0.84	2.43	34.42
June	25,331	43,842	15,301	0.48	1.66	34.90
July	33,396	49,151	19,970	0.68	1.67	40.63
August	30,360	46,091	18,847	0.66	1.61	40.89
September	24,288	31,317	12,339	0.78	1.97	39.40
Grand Total	133,646	194,669	74,810	0.69	1.79	38.43

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Total Production Figures - Ohio Mine
Analyses on Dried Basis

Year	Crude			Concentrate			Total Tailing			H.M. Rejects		Fines Tailings	
	Tons Crude	% Fe	Ton Fe Units	Tons Conc.	% Fe	Ton Fe Units	Tons Tailing	% Fe	Ton Fe Units	Tons H.M. Reject	% Fe	Tons Fine Tailing	%Fe
Webster													
1952	199,698	42.79	85,451	59,507	54.49	32,425	140,191	37.82	53,026	84,909	33.37	55,282	44.66
1953	332,951	42.19	140,472	118,481	53.39	63,257	214,470	36.00	77,215	152,680	33.86	61,790	41.30
1954	206,739	41.70	86,210	76,467	51.61	39,465	130,272	35.88	46,745	90,793	32.31	39,479	44.09
Total	739,388	42.22	312,133	254,455	53.11	135,147	484,933	36.50	176,986	328,382	33.30	156,551	43.19
Portland													
1952													
1953	16,800	42.19	7,088	6,134	53.39	3,275	10,666	35.75	3,813	7,698	33.86	2,968	40.64
1954	69,820	41.70	29,115	25,309	51.61	13,062	44,511	36.06	16,053	29,066	32.31	15,445	43.11
Total	86,620	41.80	36,203	31,443	51.96	16,337	55,177	36.01	19,866	36,764	32.64	18,413	42.71
GRAND TOTAL	826,008	42.17	348,336	285,898	52.98	151,484	540,110	36.46	196,852	365,146	33.24	174,964	43.14
Total 1952	199,698	42.79	85,451	59,507	54.49	32,425	140,191	37.82	53,026	84,909	33.37	55,282	44.66
Total 1953	349,751	42.19	147,560	124,615	53.39	66,532	225,136	36.00	81,028	160,378	33.86	64,758	41.27
Total 1954	276,559	41.70	115,325	101,776	51.61	52,527	174,783	35.93	62,798	119,859	32.31	54,924	43.81
GRAND TOTAL	826,008	42.17	348,336	285,898	52.98	151,484	540,110	36.46	196,852	365,146*	33.24	174,964	43.14

* The total Heavy Media Reject Balance is only approximate
Roughly 9,000 tons of rejects caved into old underground workings
in Nov. of 1954. Therefore, 9,000 tons are considered inaccessible
and should be subtracted from the 365,146 figure for practical purposes.

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8. BENEFICIATION: (Cont'd)

i. Production Metallurgy:

The mining of the crude ore in the East Pit was complicated during the 1954 Season by the volume of incoming water, confined working areas, and the development work which required additional equipment in the mining area. It was difficult to develop sinking cuts of any extent in the pit, consequently the height of the working face was definitely limited. As the mill feed was constantly changing, the full benefits of mill adjustments to take advantage of different concentrating characteristics were not always realized. As the season progressed, the mining operation also became more complex due to the limited amount of crude ore remaining to be mined in the Webster Lease and the restricted working areas.

With the exception of the crude ore mined during April and May, the balance of the crude ore mined during the 1954 Operating Season proved to have a lower iron and silica ratio than was anticipated by the 1953 pit control analyses maps. These pit-plant control maps were kept for the second time during 1954. It was possible through the accumulation of pit and plant data and the posting of this data on control maps to predict to some degree the occurrence in the pit of high and low grade feed as well as the feed that had the most favorable concentrating characteristics.

The grade for the year at 51.61% Fe and 9.53% SiO_2 although acceptable, did not quite meet the anticipated grade. The phosphorous and sulphur contents were both considerably higher than those realized in 1953. The phosphorous content for 1954 was .421% against .308% for 1953 and the sulphur content was .102% for 1954 as compared to .057% for 1953. When the mining in the East Pit approached the bottom cut, a considerable amount of pyrite was associated with the goethite. The fact that there is a gradation from very rich ore on the foot to a leaner material on the hanging side of the pit was still evident at depth when mining out the Webster Lease. Most of the ore mined during the 1954 season and specifically near the footwall contained appreciable amounts of calcite, pyrite with minor amounts of magnetite, martite, grunerite, aluminum oxide and chloride. Periodically zones were encountered which contained appreciable amounts of dense rock and lean iron formation. When mining in these zones, the operating specific gravity employed in the heavy media circuit was raised to a range of 3.02 to 3.10 in order to effectively reject the lean material and produce an acceptable grade concentrate. The averages of the gravities employed for 1953 were circulating media - 3.04, as compared to a circulating media gravity of 3.06 for 1954.

As old workings were encountered in the pit, a considerable amount of debris such as old rails, wood, etc. was hauled into the mill. The presence of this debris in the crude demanded that extra precautions be taken to eliminate any foreign material from entering the plant.

With the exception of the time lost during 1954 due to cold weather and the breakdown of Conveyor No. 1, the delay time was lower in most instances than previous years. The rate of hauling from the pit to stockpile was somewhat lower than the rate for the 1953 Season which again reflects the problems involved in mining out the available ore in the Webster Lease and the more complex mining operation as the season progressed. The feed rate from the stockpile to plant was slightly higher for 1954 than 1953. This increase in feed rate and lesser amount of delay time was largely due to the experienced operators and their immediate supervisors who had developed a good "know how" and operational ability for the plant.

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9. MAINTENANCE, REPAIRS, AND MILL CHANGES:

The following is a list of the major changes made in the flowsheet of the Ohio Mill before or during the 1954 Operating Season:

1. The opening of the crude ore pocket was enlarged to eliminate jamming.
2. The installation of red and green signal lights on the pocket dump station to facilitate truck dumping.
3. The installation of new conveyor belts on Conveyors No. 1 and 2 and replacing belts on Conveyors 3 and 4 with good quality used belts.
4. The installation of a sump underneath the 3 x 10 dewatering screen.
5. Warning horns were installed for conveyor startup signalling.
6. Drag chains installed at tunnel feeder to even out feed rate to plant.
7. Screen guards were installed on top deck of Ripl-Flo to improve life of screen cloth.
8. A debris screen was installed at discharging end of Low-Head screen to prevent debris from entering the media drum.
9. Washing troughs installed in the wash screens of the heavy media section to help lower media losses.
10. A sample cutter was installed at the end of Conveyor No. 5 to sample concentrates being discharged. This was a part of the investigational program to determine whether belt sampling or car top sampling is more accurate and efficient.
11. A vertical discharge line was installed on the tailings line to eliminate frequently extending tailing line.
12. During the season the stacker conveyor was extended to a total length of 220'. As the pile was extended westward, considerable settling took place. During the month of August, the pile settled considerably during one afternoon shift and the Stacker conveyor tipped over on its side. In order to resume production with as little lost time as possible, the conveyor section was cut at roughly 60', the drive unit replaced, and the belt cut and clamped. For the balance of the season the rejects were discharged alternately to the east and west. During November, the reject pile caved in one spot, evidently where the ground had given way beneath the pile exposing an old stope or underground working area and roughly 9,000 tons of rejects caved into the old workings. During the first part of the next operating season it will be necessary to discharge rejects off to the west to again build up the reject pile to form a wide base before a traveling conveyor can be utilized.
13. A 24 x 36" Denver Duplex Jig was installed during the winter and operated during the entire 1954 season. Preliminary tests indicated that the wash classifier was making an essentially minus 28 mesh separation. The minus 28 mesh crude material was sent to the hydroseparator and then to the spiral circuit. The minus 1/8" plus 28 mesh material was sent to the jig circuit or bypassed directly to the concentrate classifier. The jig produced roughly 10,043 tons of concentrate assaying 51.09% Fe and 10.35% SiO_2 in 1954. The wash classifier, when operated to bypass a jig circuit, produced roughly 6,000 tons of concentrate assaying 48.05% Fe and 13.43% SiO_2. The recovery obtained in the jig circuit during the last two months of operation was slightly lower than previously obtained, primarily due to the fact that the 2½ mm screens had worn severely and a coarser feed was being directed to the jigs. The settings required in the jig circuit during the last two months in order to reject the dense footwall rocks and produce an acceptable grade also influenced the recovery that was obtained. The jig was operated during the season changing several variables in order to produce optimum results. As it was difficult to develop and maintain a high working face in the pit, the controls and settings on the jig as well as the balance of the circuit had to be changed frequently and often so rapidly that the advantages of the settings could not be realized.

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9. MAINTENANCE, REPAIRS, AND MILL CHANGES: (Cont'd)

Often the concentrate grade from the heavy media circuit was lower than usual so that the jig and spiral concentrates had to have a low silica content in order that the overall concentrates would meet the guarantee.

The major repair project during 1954 was the installation of a new crusher mantle and bowl liner on June 10th.

Approximately 90,000 long tons of crude ore had been processed by the crusher at the time and a total adjustment of 6" had been made. A continued study of the wearing properties of different types of metal and different designs are being made. At the end of the operating season, the crusher mantle and bowl liner had worn to such a degree that replacement of these units is required before the next operating season.

Numerous other minor changes were made throughout the year in addition to a complete inspection and some repair of equipment before and after the operating season.

10. COST OF OPERATION:

a. Budget Costs:

		BUDGET		
	Year 1955	Year 1954	Year 1953	Year 1952
Tons:				
Production - Concentrates (1)	No	100,000	116,000	211,000
- Crude Ore (2)	Budget for	277,800	387,000	555,000
Cost of Production:	Year			
Pit Operating (2)	1955	$0.292	$0.270	$0.437
Total Concentrating (1)		0.928	1.303	1.200
Total Pit and Conc. (2)		0.627	0.660	0.882
Total Pit and Conc. (1)		1.740	2.203	2.320
Loading and Shipping Pocket (1)		0.050	0.070	0.030
Total Pit and Conc. Plant (1)		1.790	2.273	2.350
General Mine Expense (1)		0.511	0.750	0.500
Winter and Idle Expense (1)		0.650	0.500	0.520
Cost of Production (1)		2.951	3.523	3.370
Depr'n Amort., and Taxes (1)		0.910	0.668	1.380
Total Cost on Cars (1)		3.861	4.191	4.750

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10. COST OF OPERATION: (Cont'd)

b. Operating Costs:

	Operating Combined Webster & Portland		Webster		Portland	
	Year 1954	Year 1953	Year 1954	Year 1953	Year 1954	Year 1953
Tons:						
Production - Concentrates (1)	101,776	124,615	76,467	118,481	25,309	6,134
- Crude Ore (2)	276,559	341,485	206,739	324,685	69,820	16,800
Cost of Production:						
Pit Operating (2)	$0.394	$0.293	$0.396	$0.292	$0.388	$0.312
Total Conc. (1)	0.788	0.944	0.800	0.937	0.750	1.076
Total Pit & Conc (2)	0.684	0.637	0.692	0.634	0.660	0.705
Total Pit & Conc (1)	1.858	1.746	1.870	1.736	1.820	1.931
Loading & Shipping (1)	0.045	0.053	0.045	0.054	0.043	0.056
Total Pit and Conc Plant (1)	1.903	1.799	1.915	1.790	1.863	1.987
General Mine Expense (1)	0.486	0.574	0.490	0.575	0.474	0.553
Winter and Idle Expense (1)	0.582	0.870	0.582	0.869	0.582	0.872
Cost of Production (1)	2.971	3.243	2.987	3.234	2.919	3.412
Depr'n Amort., & Taxes (1)	1.149	0.850	0.954	0.857	1.741	0.714
Total Cost on Cars (1)	$4.120	$4.093	$3.941	$4.091	$4.660	$4.126

c. Winter and Idle Expense Costs:

	Combined Winter & Idle Webster & Portland		Winter & Idle Expense Webster Pie	Portland Pit
	Year 1954	Year 1953	Year 1954	Year 1954
Cost of Production:				
Pit Operating	993.03	-	746.09	246.94
Total Concentrating	28518.98	61505.62	21427.06	7091.92
Total Pit & Conc.	29512.01	61505.62	22173.15	7338.86
Load. & Ship. Pkt.	158.35	-	118.97	39.38
Total Pit & Cons.	29670.36	61505.62	22292.12	7378.24
General Mine Expense	29521.41	46856.44	22180.21	7341.20
Total Cost	59191.77	108362.06	44472.33	14719.44

Winter & Idle Expense

	Labor	Supplies	Total Year
Year 1954	$35,864.92	$23,326.85	$ 59,191.77
Year 1953	66,312.09	42,049.07	108,362.06
Year 1952	25,232.87	13,312.26	38,545.13

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10. COST OF OPERATION: (Cont'd)

d. Cost Comments:

The 1954 cost of production and total cost on cars at $2.971 and $4.120 per ton respectively, was under and over the budget estimate of $2.951 and $3.861. The 1954 expenditures could be representative considering the increasing replacement costs of equipment as compared to earlier break-in period costs, etc. Testing and changing of the mill operation will be an ever present factor. Depreciation, amortization and taxes have increased from $0.543 in 1952 to $0.850 and $1.149 for 1953 and 1954 respectively.

11. EXPLORATION AND FUTURE EXPLORATION:

The option to purchase the Imperial Mine property from Mrs. Ida Solem was declined late in 1954. The results of drilling hole number 20, section 25, T48N of Range 31W discouraged further exploration expenditures or expenditures of any nature relative to this property. Hole #20 was bottomed at a depth of 138 feet. 0'-51' overburden, 51' to 58' ore, 58' to 96' largely goethitic, cherty iron formation, 96'-119' unoxidized iron formation and 119' to 138' was a cherty graphitic argillite.

One diamond drill hole was put down on the Titan Lease. Results of hole number 1, Section 21, T48N of R31W, were as follows: 0'-30' overburden, 30'-42' iron formation, 42'-91' a cherty graphitic argillite.

Lease number 111 covering the Titan lands obligates the Cleveland-Cliffs Iron Company to make minimum exploration expenditures of $2500.00 for the year 1955. There will be no Ohio Mine exploration program for 1955 other than meeting the before mentioned lease requirements.

12. TAXES:

a. Valuation for 1955:

The average annual production at the Ohio considering the past three years operation was 95,299 tons and the F.O.B. mine value of this ore was $10.15 (old range non-bessemer at 51.50% natural iron lower lakes) less a 2.7131 deduction, (for upper lake rail, freight, tax, etc.) giving a F.O.B. mine value of $7.4369 per ton. Expected tax yield is 2% of the F.O.B. mine value of the ore multiplied by the total product shipped. Tax yield divided by local tax rate ($34.01 per thousand) gives a resulting valuation figure of $415,000.00.

b. Detail of Valuation and Taxes:

	1951	1952	1953	1954	1955
Value	$17,200	$370,000	$391,350*	$405,000	$415,000
Taxes	$715.51	$14,652.78	$13,438.97	$13,935.17	

* A total of $1,350 was added to take 1953 valuation following the negotiation for the Titan Lease.

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13. ACCIDENT AND PERSONAL INJURY:

There were no compensable injuries at the Ohio Mine during 1954. The Ohio Mine was the winner of the 1954 annual safety award banner for the Minnesota and Michigan open pit properties.

14. PROPOSED NEW CONSTRUCTION:

No new construction has been proposed for the year 1955.

15. EQUIPMENT RECEIVED AND PROPOSED NEW EQUIPMENT:

a. Equipment received during 1954:

1 - Speed Reducer - American #520 Shaft King.
1 - Size 340 Ingersoll Rand Impact Wrench.

b. Proposed New Equipment:

There were no proposals for 1955 purchases of new equipment for the Ohio Mine.

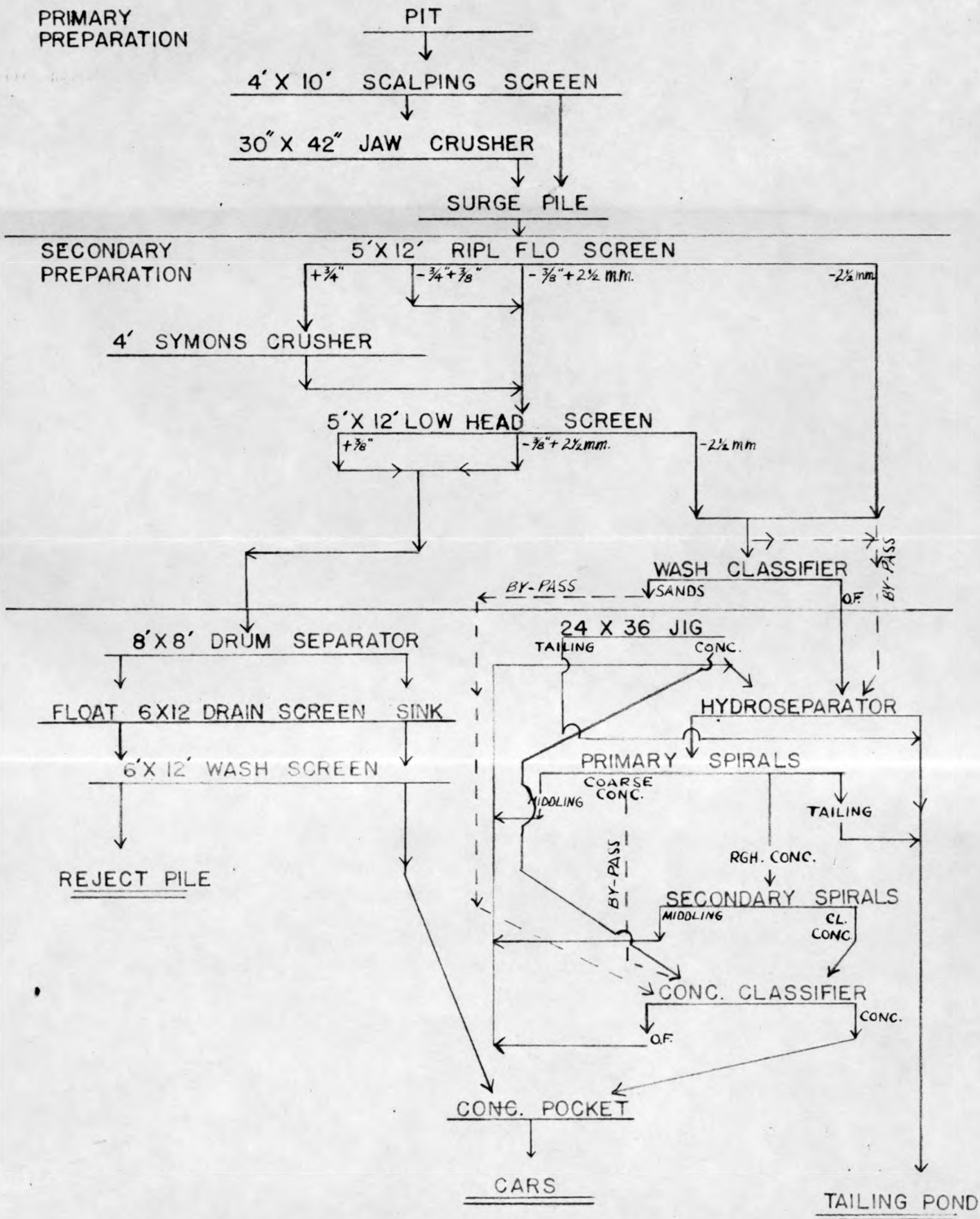
16. NATIONALITY REPORT:

	American Born			Foreign Born			Total		
Nationality	1952	1953	1954	1952	1953	1954	1952	1953	1954
French - German	2	2	2	-	-	-	2	2	2
Irish	1	2	2	-	-	-	1	2	2
English	1	1	1	-	-	-	1	1	1
Swedish	3	2	2	-	1	1	3	3	3
Swedish - French	1	1	1	-	-	-	1	1	1
Norwegian	1	1	1	-	-	-	1	1	1
French	3	3	3	-	-	-	3	3	3
Finnish	28	35	34	3	3	3	31	38	37
English - French	1	2	2	-	-	-	1	2	2
English - Finnish	1	-	-	1	-	-	1	-	-
German Dutch Swedish	1	-	-	-	-	-	1	-	-
Croatian	1	1	1	-	-	-	1	1	1
German - Swedish	1	1	1	-	-	-	1	1	1
Totals	45	51	50	3	4	4	48	55	54

All Ohio Mine personnel, salaried and hourly rate, had been transferred or given a seasonal lay off as of October 15, 1954.

OHIO MINE – FLOWSHEET

1954 SEASON



Republic Mine - April 1954

Looking North

Republic Mine - December 1954

Looking North

REPUBLIC MINE
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GENERAL

The development of the Republic Mine progressed very satisfactorily during the year 1954 and all phases of the project were well advanced by the end of December. Based on cost records to date, the entire job was 45% completed and 75% committed and expended at the start of the new year.

A total of ten contractors were active at the project during the year including the Proksch Construction Company, Hennes Trucking Company, Cloverland Contracting Company, Kielinen and Son, Joseph Hamel, Otis Elevator Company, Arrowhead Steel Company, Lindberg and Sons, Inc., Hakala and Julian, and Arthur C. Carlson. In addition, the Milwaukee Bridge Company detailed, fabricated and delivered 1383.4 tons of steel to the mine site, and the Bethlehem Steel Company detailed and supplied all the reinforcing bars required for the concrete design. Also the Abe W. Mathews Engineering Company and Mr. Ralph Boeck, Consulting Engineer, were actively engaged throughout 1954 in design problems associated with the mill and crushing plants. Other firms involved in design work included the Pittsburgh-Des Moines Company, who were concerned with the 150,000 gallon water tank and associated system, and the Swindell-Dressler Corporation, who completed a preliminary design and cost estimate for an agglomeration plant to handle Republic ore. During the year, it was decided to move the site of this proposed agglomeration plant to a location east of Negaunee.

The two photographs on the preceding page show visually the progress realized on the mill and crushing plants during 1954. In April only the rod and ball mill foundations immediately to the rear and right of the office-shop-dry building are clearly in view. The primary and secondary crushing sites can be seen as excavations to the left of the office building. The second photo records the project at the end of December, 1954 and shows the primary crushing building completely enclosed, the main columns of the secondary crushing building standing, and the mill 60% erected.

The tables that follow summarize the expenditures made during 1955 under E&A CC-491 by accounts and also the totals paid to each contractor listed above.

Since the activities throughout the year were closely related to the E&A Statement as set up for the Republic Mine, the remainder of this report will follow the E&A framework.

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TABLE I.

EXPENDITURES MADE UNDER E&A CC-491 DURING YEAR 1954

A.	General Expense	$ 35,276.14
B.	General Surface	33,164.17
C.	Shop, Office & Dry Building	104,743.56
D.	Concentrating Plant	
	a. Crushing Section	600,015.75
	b. Concentrator Section	1,027,158.90
	c. Stocking & Shipping Section	4,261.08
	d. Reagent Storage	4.00
E.	Power Distribution	50,091.25
* F.	Pelletizing Plant	61,525.66
G.	Mining Equipment	141,209.71
H.	Water Supply	8,289.64
I.	Tailings Disposal	2,155.31
	Townsite Development	89,253.31
	TOTAL	$ 2,034,097.16

* The credit under "F" (Pelletizing Plant) is due to the transferring of a portion of previous expenditures to E&A CC-565.

PROJECT	CONTRACTOR	CONTRACT AMOUNT *	PAID IN 1953	PAID IN 1954	REMARKS
Excavation for Primary Crusher Building & No. 1 Conveyor Tunnel	A. Lindberg & Sons, Inc.	$ 88,719.96	$ 76,681.90	$ 12,038.06	Contract Completed.
Construct Shop, Office & Dry Building	Proksch Construction Company	393,135.93	273,286.46	100,708.77	Contract near completion.
Excavation, Concrete and Backfill for Crushing and Concentrator Sections	Proksch Construction Company	358,088.31	44,054.56	296,129.33	Contract near completion.
Furnish and Erect Structural Steel for Crushing and Concentrator Sections	Milwaukee Bridge Company	645,382.20	-	338,821.17	
Mechanical & Electrical Work for Crushing & Concentrator Sections	Cloverland Contracting Company	523,708.80	4,362.37	254,846.63	
Clearing and Brushing	A. C. Carlson	9,090.00	5,850.00	3,240.00	Contract Completed.
Sheeting, Roofing, Flashing and Insulation	Arrowhead Steel Bldgs. Inc.	177,172.00	-	71,511.12	
Install Storm & Sanitary Sewers; Unload & Erect 2 Shop Cranes, and Install 1 - 20,000 Gal. Tank	Proksch Construction Company	19,995.50	-	19,995.50	Contracts Completed.
Furnish and Install one Freight Elevator	Otis Elevator Company	12,533.00	-	11,279.70	Contract near completion.
Miscellaneous Projects **	Joseph Hamel	10,590.60	5,677.84	4,912.76	Contracts Completed.
Construct Built-up Roof on Mill Building	H. H. Pellow & Sons, Inc.	37,406.00	-	-	Not started as yet.
Concrete Block Work & Install Wood Nailers & Flooring	Kielinen & Son	11,061.00	-	4,098.60	
Grading Work for new Republic Townsite	A. Lindberg & Sons, Inc.	7,960.00	-	7,164.00	

TABLE II.

TABLE II. (CONT'D.)

PROJECT	CONTRACTOR	CONTRACT AMOUNT *	PAID IN 1953	PAID IN 1954	REMARKS
Furnish & Erect Water Tank	Pittsburgh-Des Moines Steel Company	$ 35,300.00	$ -	-	Scheduled for Summer of 1955.
Unload, Store & Install Machinery & Equipment for Plant	John Hennes Trucking Company	132,021.70	-	1,522.50	
Drill Test Holes for Water-Plat	Hakala & Julian	1,672.75	-	1,672.75	
Furnish, erect all grating, stair treads & Pipe railing for Plant	Milwaukee Bridge Company	65,375.00	-	8,825.31	
TOTAL		$ 2,529,212.75	$ 409,913.13	$ 1,136,766.20	

* The amounts shown are subject to escalation as permitted by contract and are not final except for contracts which have been completed.

** Includes jobs such as installing storm sewers, constructing manholes, installing potable water supply (1953), unloading railroad carload shipments, and earthwork.

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A. GENERAL EXPENSE

At the start of the year 1954, the Republic Mine staff totalled ten people, including a superintendent, clerk, secretary, two engineers, two surveyors, two surveyor's helpers, and one representative for the Abe W. Mathews Engineering Company. Also, a four-man crew was engaged in the surveying and preliminary planning of the townsite.

During the first quarter, in addition to construction engineering duties, the engineering staff completed the profiling of the initially proposed mining area as well as the field and office engineering associated with the layout of the tailings disposal system. Also the staff surveyed lines from the mine site to the Michigamme River and Milwaukee Lake to determine the route of the fresh and reuse water lines, and studied in cooperation with L. S. & I. officials the layout and route of an additional spur to handle direct shipping and Tilden grade ore.

In March of this quarter, Mr. E. W. Lindroos, District Metallurgist for the Cleveland-Cliffs Iron Company, who had been directing the Republic development, was named Assistant Superintendent of the Humboldt Mine, and Mr. K. C. Olson, Assistant Superintendent of the Ohio and Tilden Mines, was transferred to the Republic project.

Early in the second quarter, engineering efforts were directed towards preparing for the summer stripping and grading program.

In May following the decision to advance all earthwork to 1955, the engineering staff was reduced to two men who would devote full time to Republic Mine and mill development, and one man who would work part-time on the new townsite project.

During the remainder of the second and throughout the third and fourth quarters, engineering work was confined to construction duties in both the mine and townsite developments. However, at the end of the year, time was again consumed on adjusting estimates and plans for the 1955 grading, excavating, stripping, ditching and diking work required.

From the first of the year through May, the part-time services of a geologist were also utilized developing geological sections of the Republic ore body and studying the old underground maps to help in the long range planning of haulage roads and pit development.

Early in the fourth quarter, a limited watchman service was started with one policeman covering all the Cleveland-Cliffs Iron Company's open pits.

B. GENERAL SURFACE

The job of developing a sewage disposal system for the office and dry was nearly completed by the end of January and represented the major project during the first quarter under the above category. This work included a septic tank, dosing chamber, drain field, storm and sanitary sewers and several manholes, and was undertaken by the Proksch Construction Company.

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B. GENERAL SURFACE (CONT'D.)

In early April, a short railroad spur was completed which provided an area to unload and erect a 120-B Bucyrus-Erie power shovel from the Tilden Mine. The grading of the spur was handled by Joseph Hamel, contractor, and the track was laid by the L. S. and I. R.R. Company. The shovel was erected during the last half of April and was in operating condition by the first week in May.

During April, Arthur C. Carlson contracted to clear and grub in the mining area along the southern footwall contact and immediately west of the primary crushing building. This work was terminated early in May following the decision to delay stripping and grading plans until 1955. A small amount of work on a footwall access road to the old rockpile was also completed before this work was advanced to 1955.

The installation of the 20,000 gallon diesel fuel tank was completed by the Proksch Construction Company during May.

Further work was awarded to Joseph Hamel to complete the drainage system south of the office and three manholes and storm sewers were completed during the second quarter. During June, a large rock outcrop immediately south of the primary crushing building was drilled and blasted. This work became necessary since the outcrop was in line and considerably above the grade of the pit road approach to the crushing plant, and blasting after the steel was erected would have resulted in damage to the building.

Early in the third quarter, gates were placed at all entrances to the property as an excessive number of visitors were gaining access to the area.

A large ditch involving earth and rock excavation amounting to 1298 cu. yds. and extending from the mill to the primary crushing plant was completed in the third quarter. By October, the Cloverland Contracting Company had installed and tested the 20" mill fresh water line, the 6" fire main, and the potable water line that were intended to run throughout or in portions of this ditch.

In September, a small group of Company personnel was assembled to haul 2200 cu. yds. of gravel as protection for manholes and sewer lines and also to treat a carload of wood nailers with creosote.

In late October, before the start of the inclement weather, the railroad track at the mine site was extended into the mill building by crews of the L. S. & I. R.R. Company.

C. SHOP-OFFICE-DRY BUILDING

Despite weather conditions, the Proksch Construction Company completed the enclosing of this building by the end of March. Since the major portion of the structural steel had been erected in December of 1953, the work in this period was confined to steel alignment, installation of the steel roof deck and tarring the roof, placing of concrete blocks on the outside walls, and setting miscellaneous steel, including the door and window frames. Also in March the job of placing insulation, hanging space heaters, pouring concrete for the office floor and installing garage doors was undertaken.

C. SHOP-OFFICE-DRY BUILDING (CONT'D.)

During April and May, efforts were directed at completing the interior of the building. On May 28th, the equipment and records from the temporary mine office in the Village of Republic were moved to the new building and formal occupation began on Tuesday, June 1st.

The contractor continued work on the building through September, completing the electrical and plumbing portions of the contract early in the third quarter and the painting by the end of September. Also in September, the Cleveland-Cliffs Iron Company personnel started the wiring of the shop cranes and other miscellaneous electrical jobs not covered in the building contract.

Although completed at the end of the year, except for very minor details, final payment was not awarded to the Proksch Construction Company because of damage to the roof caused by blasting by the Proksch Company throughout the area during the summer construction work. Following roof repairs in the spring when weather will permit such work, the contract for this building will be terminated.

D. CONCENTRATING PLANT

a. Crushing Section (Tables III, IV and V outline the total excavation, concrete work and backfill completed during 1954)

1. Construction

Construction work during the first quarter was centered on the primary crushing shaft and No. 1 conveyor tunnel. As can be noted from Table IV, the Proksch Construction Company poured concrete for the shaft lining throughout the quarter, and completed 75% at the end of March. The Proksch Construction Company also excavated for the fine crushing building and machinery footings within this period. A. Lindberg and Sons, Inc. completed the enlarging of the No. 1 conveyor tunnel on February 17, 1954, and the contract for the crusher excavation was terminated in March.

Throughout most of the second quarter, construction efforts were concentrated on completing the concrete work in the primary crushing building and the excavation work for the fine crushing building. During June, however, the pouring of concrete was started in the fine crushing building and the erection of the main structural steel columns for the primary building got underway.

By the end of July, in the third quarter, the primary crushing plant was about wholly erected and the 60-ton crane was in place. Also during July, an electric sump pump and associated wiring and plumbing were installed to dewater the shaft. A crew of miners from the Mather "A" were employed during July to bar down loose material from the back of the primary conveyor tunnel and scrape the drift clean.

Concrete and steel work continued to advance well and by the end of the third quarter, with the exception of nine cubic yards, all concrete work in both crushing buildings was completed, and the primary building steel was plumbed and riveted.

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D. CONCENTRATING PLANT (CONT'D.)

a. Crushing Section (Cont'd.)

1. Construction (Cont'd.)

The Arrowhead Steel Company, Inc. initiated work on their sheeting contract in September and had 50% of the primary crushing building completed at the end of the month. Also starting with the Arrowhead Company was the contracting firm of Kielinen and Son who was awarded the contract for placing the wood nailers to which the galvanized sheeting is attached.

Following the installation of the steel stairway in the primary building during July, the plumbers and electricians of the Cloverland Contracting Company started work on this building on a larger scale.

Pouring concrete for conveyor footings and transfer houses was started in September and continued into the fourth quarter. With the pouring of the top portion of the No. 1 conveyor tunnel and transition house during the first half of December, all concrete work for the entire crushing section was completed.

By the end of October, the sheeting on the primary building was also almost completed, with the exception of the enclosing of the elevator shaft which would necessarily have to wait for the elevator installation. Included in this completed sheeting work was the green translucent corrugated plastic roof section over the dumping area.

Design changes necessitated the removing of portions of the primary crusher foundation which would facilitate the installation and operation of a pan feeder that will be placed below the primary crusher. This work was handled by Cleveland-Cliffs Iron Company personnel during October and November.

Late in November, the Otis Elevator Company began the installation of the service elevator in the primary crushing building and continued this work throughout the remainder of the year. A second vertical type pump to dewater the elevator sump was also installed in the shaft at this time.

The Cloverland Contracting Company continued the plumbing and electrical work in the primary building throughout the last quarter and at the year's end completed most of the work not directly connected with machinery such as the exterior and interior lighting requirements, as well as the installation of a 225 KVA transformer and motor control units.

During the last month of the year the Hennes Trucking Company began the erection of the secondary crushing building and had most of the main columns standing by December 31st.

2. Design

The basic design and layout of the Republic crushing plants were complete at the end of 1953. The detailed drawings showing the concrete and steel designs, as well as the equipment layout, were completed close to schedule and allowed the construction advancement as described above. However, three major changes in design were made during the year and incorporated into the construction program. In March the primary crushing plant foundation was modified

D. CONCENTRATING PLANT (CONT'D.)

a. Crushing Section (Cont'd.)

2. Design (Cont'd.)

to provide a dead-bed dumping area on the south side of the crusher to make that side symmetrical with the north side. This change would allow a second type of feeding arrangement to the crusher, if direct dumping became prohibitive.

During April, it was decided to eliminate the use of the Ross feeder as a regulator to the flow of ore from the primary crusher storage area to the No. 1 conveyor belt. As an improvement, a change in the concrete and steel design was made to facilitate the installation of a Pioneer pan feeder in the crusher storage area which would act as a conveying unit for moving the ore onto the No. 1 conveyor belt. Previously it was assumed that the ore would readily flow from the storage area through the use of a dead-bed arrangement and a Ross feeder. This change was deemed necessary because of experience at the Humboldt Mine which indicated a more positive action was needed to move the ore from the storage area.

During the last half of the year, considerable attention and study was given to the No. 1 conveyor tunnel. Although it had previously been intended to have a naked drift, it was decided after due consideration of all types of tunnel support to concrete the tunnel. This concrete design, as well as plans for executing the job, were complete at the end of the year with the actual work scheduled to start in January of 1955.

TABLE III.

CUBIC YARDS OF EXCAVATION - 1954**

Month	Primary Crushing Building	Fine Crushing Building	Mill	No. 1 Conveyor Tunnel & Transition House	Conveyors No. 2 & 3 & Transfer House	No. 4 Conveyor	No. 11 Conveyor	Main Water Ditch	Water Tank	Loading Pocket	Total Earth	Total Rock
January												
		2430.0*									2430.0	
February		7.0*										7.00
	10.0										10.0	
March	5.50											5.50
	240.3										240.3	
April	37.19											37.19
		16.0	2500.0								2516.0	
May	2.00	2.70	103.08									107.78
		47.0									47.0	
June	3.00	38.50	3.00									44.50
			149.9					300.0			449.9	
July			212.38					113.75				326.13
		4.0	407.3		45.8			470.9			928.0	
August		8.56	88.73		13.63			68.50				179.42
		17.0	44.1		154.4	268.0		190.1			673.6	
September			2.70			13.00		104.64				120.34
			115.0	347.7				25.0	45.0		532.7	
October			6.92			2.98		0.01	15.00			24.91
				4.0	10.0		97.0				111.0	
November				5.00			1.50					6.50
								25.0		93.0	118.0	
December												
Earth	250.3	2514.0	3216.3	351.7	210.2	268.0	97.0	1011.0	45.0	93.0	8056.5	
Rock	47.69	56.76	416.81	5.00	13.63	15.98	1.50	286.90	15.0			859.27

*Top figure between lines indicates earth excavation; bottom figure indicates rock excavation.

**Excludes 150 cu. yards of rock stripped from No. 1 conveyor tunnel during the first quarter.

TABLE IV.

CUBIC YARDS OF CONCRETE POURED - 1954 *

Month	Primary Crushing Building	Fine Crushing Building	Mill	Conveyors No. 1-2-3 4-11 Footings	No. 1 Conveyor Tunnel & Transition House	Conveyors No. 2 & 3 & Transfer House	Conveyors No. 10 & 11 Transfer House	Loading Pocket	Water Tank	Miscellaneous	Total
January	292.90		146.0								438.90
February	232.20		262.40								494.60
March	61.60										61.60
April	150.30										150.30
May	221.50		52.37								273.87
June	52.60	281.90	240.80								575.30
July		447.00	572.00								1019.00
August	15.00	69.50	371.30	17.00		5.0					477.80
September	14.50	75.00	354.75	50.50		22.50					517.25
October		8.75	335.25	9.25	31.75	11.50			22.50	5.75	424.75
November			0.50	4.00	114.00		26.25		81.0	1.20	226.95
December			74.00	2.00	44.66			29.50			150.16
TOTAL	1040.60	882.15	2409.37	82.75	190.41	39.00	26.25	29.50	103.50	6.95	4810.48

* Excludes 187 cu. yards of concrete poured for the Shop-Office-Dry Building during the first quarter.

TABLE V.

CUBIC YARDS OF BACKFILL - 1954 *

Month	Primary Crushing Building	Fine Crushing Building	Mill	No. 1 Conveyor Tunnel & Transition House	Conveyors No. 2 & 3 & Transfer House	No. 4 Conveyor	No. 11 Conveyor	Loading Pocket	Sewer Lines	Railroad Spur	Total
January											
February											
March											
April										800.0	800.0
May											
June	1734.0										1734.0
July											
August	18.2	2240.0	5580.0								7838.2
September		1075.8	1600.0		84.0				2200.0**		4959.8
October			1578.6	48.0	80.0	45.6					1752.2
November			12.0	373.0	41.2		91.2				517.4
December								59.3			59.3
TOTAL	1752.2	3315.8	8770.6	421.0	205.2	45.6	91.2	59.3	2200.0	800.0	17660.9

* Includes only pit-run gravel hauled to the mine site.

** By Cleveland-Cliffs Iron Company personnel.

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D. CONCENTRATING PLANT

b. Concentrator Section

1. Construction

During the first quarter, work on the concentrating plant was limited to the pouring of the four Hardinge grinding mill foundations which were completed by the end of February. No further development occurred until May when the remainder of the mill site was excavated to ledge, the rock prepared, and several footings were formed and poured. As can be noted from the tables, excavation, concrete work and backfilling advanced well throughout the following months, with this work including all necessary underfloor piping. Completion was achieved by the end of October.

Excavation work also started in October on the transfer house between conveyors 10 and 11, and the No. 11 conveyor that runs down the hillside to the railroad loading pocket.

With the concrete work almost completed in October, steel erection commenced along the west wall of the building which involved the setting of the large storage bins.

Steel work continued throughout the remainder of the year with approximately 60% of the mill steel being in place at the end of December as well as one 5-ton crane in the repair bay.

A small amount of concrete work was completed in November and December, including footings for the conveyor system between the mill and the pocket (conveyors 10 and 11), the repair bay upper floor slab, and the railroad loading pocket.

The Arrowhead Company also started sheeting the west wall of the mill building early in December and the Cloverland Contracting Company completed a small portion of the piping and electrical work. A limited quantity of this work was scheduled at that time to avoid delays caused by a large build-up of this type of work when machinery is installed.

2. Design

As in the case of the crushing section, the basic layout and design of the Republic mill were almost complete at the beginning of the year and the detailed drawings showing concrete and steel design were also near completion. Since all electric motors had not been selected, the electrical design was only in the initial stages at this time. During the year while finishing all phases of the mill design, several major changes were made on the basic layout and approved for final construction.

During the first quarter, the reagent storage facilities were moved from a separate building to within the mill proper, requiring alterations in the foundation, electrical and piping design.

In April, a change was made in the east end of the building because of the need for deeper wells in the thickeners. This resulted in a lower floor elevation in this portion of the mill and a general change in the concrete design of

D. CONCENTRATING PLANT (CONT'D.)

b. Concentrator Section (Cont'd.)

2. Design (Cont'd.)

the east wall of the mill. At this time, the rubber-lined slurry pumps on order for the Republic plant were cancelled until a further study could be made of pumping a pulp ladened with froth. Also it was decided to begin considering a fresh water pumphouse and pump layout on the Michigamme River that would handle all the required water for the mill and fire protection system. In this case, after operating for an estimated eight to twelve months, during which time the tailings basin would fill and a recirculation system would start, a portion of the pumping equipment would be moved to Milwaukee Lake which would serve as a receiving basin for the settled tailings water.

After studying the pumping problem associated with the flotation section of the mill, it was decided in August to introduce a gravity flow system in the flotation section of the Republic plant. Also at this time a recleaning stage was added to the flotation section that was intended as an aid in producing a better grade product than was originally estimated.

Both of these latter design changes resulted in a large change in the structural steel setup and in the flotation machines required. Also resulting from this change was the redesigning of the piping and laundering in the flotation section, as well as the sump and pump layout. At this time, the flotation and desliming pumps were ordered again.

Although numerous minor field changes were made throughout the year on all phases of this project, including the crushing plants and service building, a large portion of time was directed to the installation of piping in the buildings. This design work was not completely detailed and depended on field engineering for final placement.

The table that follows outlines equipment ordered or received during 1954 that will be installed in the Republic mill and crushing plants.

TABLE VI.

MAJOR EQUIPMENT ORDERED AND/OR RECEIVED
FOR REPUBLIC MILL AND CRUSHING PLANTS
DURING YEAR 1954

ITEM	MAKE	DATE ORDERED	DATE RECEIVED	REMARKS
1 - 30-ton Crane	P. & H.	8/25/53	6/24/54	Mill
1 - 30-ton Crane	P. & H.	8/25/53	6/26/54	Secondary Crushing Plt
1 - 60-ton Crane	P. & H.	8/25/53	7/12/54	Primary Crushing Plt.
Dust Seal Tripper	Hewitt-Robins	10/9/53	10/7/54	Mill
Lifting Magnet	Cutler-Hammer	1/21/54	7/6/54	Mill
Water Tank, 150,000 gal.	Pittsburgh-Des Moines	1/26/54	-	Process Water Supply Tank
Transportometer	Sintering Machinery	1/26/54	-	Mill
Conveyoflo Meter	Builders-Providence	1/27/54	-	Mill
Samplers	Denver Equipment	2/1/54	-	Mill
Vacuum Pump Drives	American Pulley	2/8/54	-	Mill (Filter Bay)
Overhead Doors	Kinnear	2/16/54	9/1/54	Primary Crushing Plt.
Motor Generator Set	Crocker-Wheeler	2/19/54	6/24/54	Primary Crushing Plt.
Overhead Doors	Overhead Door Corp.	3/5/54	5/19/54	Secondary Crushing Plant and Mill
Sump Pump	Hazleton	3/26/54	10/15/54	Mill (Filter Bay)
Small Cranes	Wright Hoist Div.	3/30/54	8/10/54	Secondary Crushing Plant and Mill
Apron Feeder	Pioneer	6/15/54	-	Primary Crushing Plt.
Pan Feeder Reducer	Falk	7/9/54	-	Primary Crushing Plt.
Drives	American Pulley	7/9/54	-	Primary Crushing Plt.
Motor	Elliott	7/9/54	-	Primary Crushing Plt.
Fine Ore Feeders	Link-Belt	10/15/54	-	Mill
Flotation Machines	Denver Equipment	10/25/54	-	Mill Unit II.
Flotation Machines	Fagergren	10/25/54	-	Mill Unit I.

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E. POWER DISTRIBUTION

The power distribution system at the Republic Mine remained on a temporary basis throughout the year with ground cables carrying power throughout the area to provide the necessary service.

In February, three 2000 KVA transformers were transported to the site of the permanent substation by the U. P. Power Company. No further work was completed on this substation until October when the transite pipes that will carry the power cables from the substation to the main distribution center in the mill were installed and covered with concrete where damage was a possibility. During November the concrete floor of the substation was poured.

The Cloverland Contracting Company received the bulk of the transformers and switchgear required for the final power distribution system and this equipment was in place but not wired as of the end of the year.

F. PELLETIZING PLANT

During January and February of the year, testing for ledge was carried on with the use of a churn drill. The intent of this work was to determine the type of foundation necessary for the coal and limestone pulverizing plant associated with the pellet plant proper.

Also during this period, the Swindell-Dressler Corporation continued with the preliminary design and estimate for the entire plant, completing this work in March. These plans and specifications were distributed to contractors in April and numerous engineers representing contracting firms visited the proposed plant site during April and May, with the bids being opened in July. During the following months, consideration was given to the moving of the proposed Republic agglomerating plant to another site. This decision was reached within the third quarter, resulting in an additional engineering program to complete the details associated with this change.

Throughout the remainder of the year, therefore, efforts were concentrated on redesigning the mill for adaptation to a new plant site and also in preparing layout and grading sheets of the new area. This work became especially important at the start of the fourth quarter when the McDowell Company of Cleveland was named the general contractor for the agglomerating plant.

In December, bids were received for the job of clearing and grading the new plant site east of Negaunee, with the actual work scheduled for January, February and March.

G. MINING EQUIPMENT

In anticipation of grading and diking in 1954, a 54-B Bucyrus-Erie shovel, five 34-ton Euclids, a D-8 caterpillar tractor, and a caterpillar motor grader were received in the spring. The 54-B shovel was delivered to the Tilden Mine and by early May, the 120-B Bucyrus-Erie power shovel from the Tilden Mine was transferred and erected at the Republic Mine.

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G. MINING EQUIPMENT (CONT'D.)

Following the decision to postpone earth work until 1955, no other major items were received until December when an Ingersoll-Rand 600 CFM air compressor was purchased and rented to the Humboldt Mining Company. One other piece of equipment was committed for purchase during December when a jet piercing machine was ordered for delivery in late 1955.

H. WATER SUPPLY

Actual installation of water supply facilities in 1955 was limited to the east-west ditching project and the laying of potable water, fire and mill lines within the ditch, as described under "General Surface". Also the footings and valve pit for the water tank were poured by the Proksch Construction Company during October and November.

One major layout change was made in moving the water tank from a hilltop point north of the main east-west water lines to a location over the lines.

Special attention was given throughout the year to locating the proper route of the fresh water line from the Michigamme River to the water tank and to negotiations with the Pittsburgh-Des Moines Company regarding the design of the water tank.

I. TAILINGS DISPOSAL

Construction of the tailings disposal system was advanced to 1955, limiting work on this project during 1954 to engineering studies. The area was surveyed during January, February and March of the year with several resultant plans being formulated. Following land negotiations, a final plan was completed which permitted the enclosing of approximately 280 acres if a dike elevation of 1530 feet was maintained. In this system, the tailings would flow in a large semi-circle throughout an area directly southeast of the mill with clear water eventually returning to Milwaukee Lake where a reuse pump station would be located. Any excess water in Milwaukee Lake would be drained in a northwest direction to the Michigamme River.

J. TOWNSITE

Throughout the year, progress was made in obtaining land and initiating a program for the development of a new townsite near Republic, Michigan.

Negotiations for land acquisition that started in 1953 were continued into January of 1954 and, at that time, options were taken on several parcels in Section 19, T. 46, R. 29. The surveying of these lands and preliminary planning for the townsite were completed by April with the deeds for the lands also being acquired by the end of this month. Additional studies concerning pit development followed in an effort to determine the number of houses to be moved over a two-year period. This study resulted in a decision to move thirteen families in 1955 and an additional twenty-two in 1956.

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J. TOWNSITE (CONT'D.)

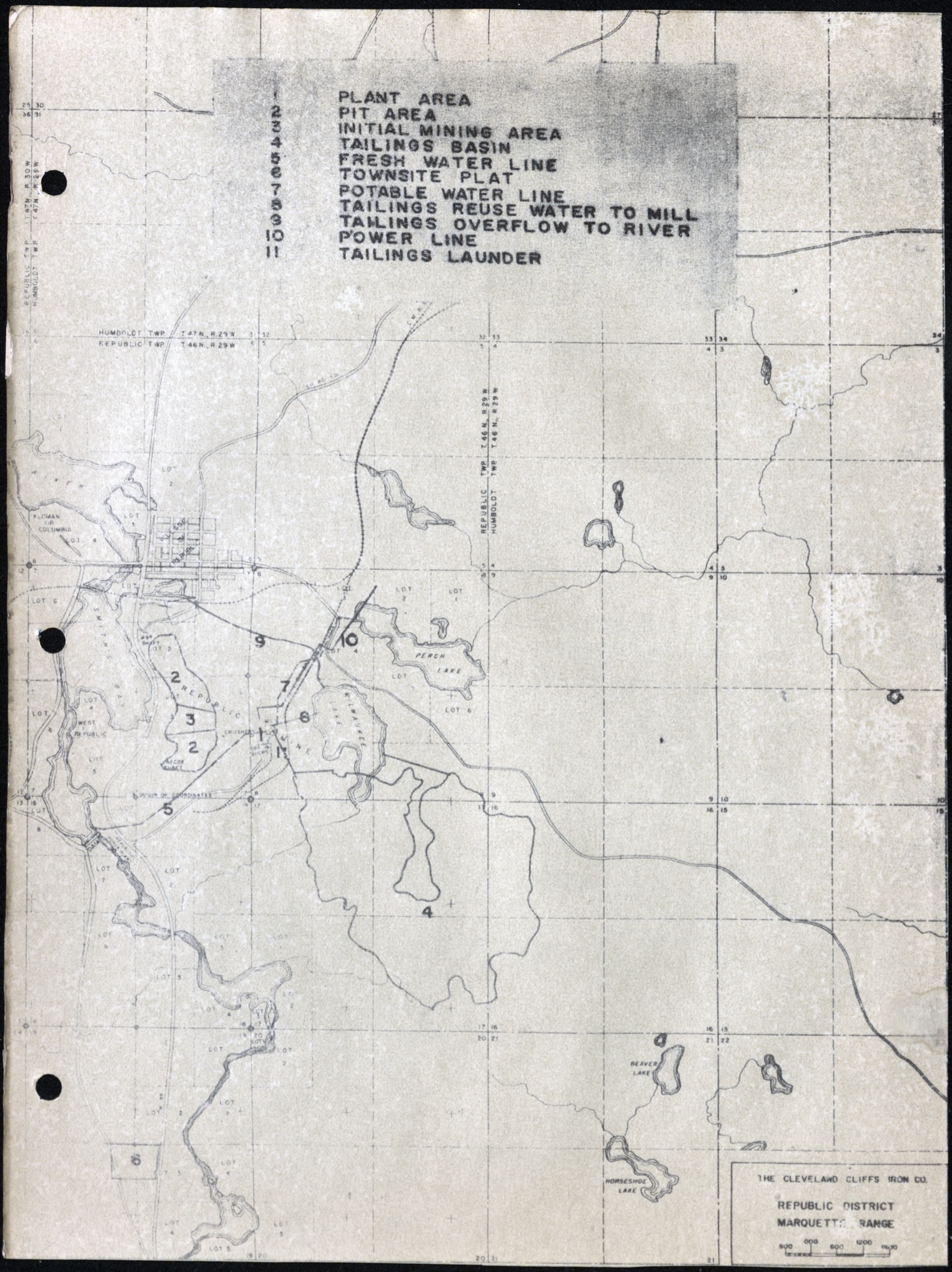
In August, engineering work was resumed on the townsite with detailed layouts and estimates being prepared for the central area of the plat which would be the first to be developed. This work, including the detailed plans for water and sewer mains, as well as proposed well setups and sewage disposal units, was completed in October. In November, A. Lindberg and Sons, Inc. began the grading of the initial area scheduled for development with the project being 90% completed at the end of the year.

Also in November, a program of well-test hole drilling was undertaken to determine if an adequate water supply was available from wells. A total of three holes were drilled during November and December without finding a satisfactory source of water.

TAXES

The following table compares the taxes assessed the Republic Mine and surrounding lands in 1953 and 1954:

Description	1954 Valuation	1954 Taxes	1953 Valuation	1953 Taxes
Republic Township				
Realty as described on tax receipt	52,575	1,035.46	8,550	172.71
Personal Property	30,000	590.85	-	-
Lots 71, 72, 85 and 108	200	3.95	200	4.04
Total Republic Mine	82,775	1,630.26	8,750	176.75
Standard Mine NE¼ of Sec. 34, T. 47, R. 30	1,450	28.56	1,450	29.29
Auxiliary Lands	4,500	88.64	775	15.66
Mineral Lands	-	-	33,725	681.25
TOTAL REPUBLIC TOWNSHIP	88,725	1,747.46	44,700	902.95
Tax Rate	19.50		20.00	


1 PLANT AREA
2 PIT AREA
3 INITIAL MINING AREA
4 TAILINGS BASIN
5 FRESH WATER LINE
6 TOWNSITE PLAT
7 POTABLE WATER LINE
8 TAILINGS REUSE WATER TO MILL
9 TAILINGS OVERFLOW TO RIVER
10 POWER LINE
11 TAILINGS LAUNDER
HUMBOLDT TWP. T.47N., R.29W.
REPUBLIC TWP. T.46N., R.29W.
REPUBLIC TWP. T.46N., R.29W.
HUMBOLDT TWP. T.46N., R.29W.
REPUBLIC TWP. T.47N., R.30W.
HUMBOLDT TWP. T.47N., R.30W.
KLOMAN OR COLUMBIA
PERCH LAKE
MILWAUKEE LAKE
BEAVER LAKE
HORSESHOE LAKE
WEST REPUBLIC
CRUSHER PLANT
THE CLEVELAND CLIFFS IRON CO.
REPUBLIC DISTRICT
MARQUETTE RANGE

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The Tilden Mine did not operate during 1954, activities being limited wholly to loading from the stockpile.

1. SHIPMENTS AND ORE STATEMENT FOR YEAR 1954:

a. Shipments:

Grade	Pocket	Stockpile	Total
Tilden Silica	0	77,781	77,781
Tilden Low Phos.	0	0	0

b. Ore Statement, December 31st, 1954:

	Tilden Silica	Tilden Low Phos.	Total
On Hand, January 1st, 1954	54,117	21,700	75,817
Production for 1 9 5 4	0	0	0
Transfers	2,826	2,826	
Overruns	20,838		20,838
Total	77,781	18,874	96,655
Shipments	77,781		77,781
Balance on Hand		18,874	18,874

c. Comparison of Shipments - 7 Year Period: (1948-1954)

Year	Tons Silica	Tons Low Phos	Total Year	Yearly Decrease	Yearly Increase
1948	78,641	43,750	122,391		
1949	69,446	9,373	78,819	43,572	
1950	91,510	23,926	115,436		36,617
1951	78,627	9,959	88,586	26,850	
1952	64,590	15,859	80,449	8,137	
1953	83,896	19,497	103,393		22,944
1954	77,781		77,781	25,612	

2. ANALYSIS:

a. Analysis of Shipments:

Grade	From	To	Tons	Iron	Phos.	Sil.	Moist.	Sul.
Tilden Silica	Stockpile	Presqu' Isle	74,304	39.74	.030	41.77	2.76	.005
Tilden Silica	Stockpile	Edison Foundry	651	39.71	.030	41.54	3.19	.006
Tilden Low Phos (Trsf)	"	Presqu' Isle	2,826	36.88	.017	46.89	1.40	.005

Composite Analysis of Shipments:

	Tons	Iron	Phos.	Sil.	Mn.	Al.	Ca.	Mg.	Sul.	Loss by Ig.	Moist.
Tilden Silica											
Natural	77,781	38.51	.030	40.91	.06	.59	.14	.19	.005	.21	2.74
Dried	77,781	39.60	.031	42.06	.06	.61	.14	.20	.005	.22	

b. Analysis of Ore Remaining in Stockpile: (Estimated)

Grade	Tons	Iron	Phos.	Sil.	Sul.	Moist.
Tilden Low Phos.	18,874	36.00	.013	46.90	.010	2.32

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3. ESTIMATE OF ORE RESERVES:

a. Summary of Estimate of Ore Reserves:

	Developed	Prospective	Total Tons
Ore Reserves as of Jan. 1, 1954	4,457,595	2,735,500	7,193,095
Less Production - 1 9 5 4			
Ore Reserves as of Dec. 31, 1954	4,457,595	2,735,500	7,193,095

b. Expected Average Analysis of Ore Reserves:

	Tons	Iron	Phos	Sil	Mang	Sul	Moisture
Tilden Developed	4,457,595	37.94	.028	43.51	0.090	0.009	1.690
Tilden Prospective	2,735,500	36.90	.026	42.90	0.090	0.009	1.650
Total	7,193,095						

c. Developed Ore;

1. West Pit - Above Floor at 1430'

Assumption: 13 Cubic Feet Equals One Ton

Total Stripped and Developed as of January 1, 1954	1,210,857 Tons
Mined During 1 9 5 4	0
Total Remaining December 31, 1954	1,210,857 Tons

2. East Pit - Above Floor at 1440'

Assumption: 14 Cubic Feet Equals One Ton

Total Stripped and Developed as of January 1, 1954	2,908,238 Tons
Mined During 1 9 5 4	0
Total Remaining December 31, 1954	2,908,238 Tons

3. Summit Pit - Above Floor at 1620'

Assumption: 14 Cubic Feet Equals One Ton

Total Stripped and Developed as of January 1, 1954	338,500 Tons
Mined During 1 9 5 4	0
Total Remaining December 31, 1954	338,500 Tons

4. Total Developed Ore as of December 31, 1954

West Pit	1,210,857
East Pit	2,908,238
Summit Pit	338,500
Total All Pits	4,457,595

d. Total Prospective Ore:

1. West Pit:
Balance remaining to be stripped in east half of Upper Bench 500,000 Tons

2. East and Summit Pits:
Total above 1500' lying north and east of the East Pit 2,235,500 Tons

Total Prospective Ore as of December 31, 1954 2,735,500 Tons

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3. ESTIMATE OF ORE RESERVES: (Continued)
e. Estimated Analysis of Reserves:

	Pit	Iron	Phos	Sil	Mang	Alum	Lime	Mag	Sul	Loss	Moisture
1.	West Pit										
	Dried	39.17	0.050	41.91	0.09	0.90	0.20	0.22	0.009	0.24	
	Natural	38.50	0.049	41.20	0.09	0.88	0.20	0.22	0.009	0.24	1.70
2.	East Pit										
	Dried	37.00	0.020	45.00	0.09	0.54	0.20	0.17	0.009	0.34	
	Natural	36.50	0.020	44.40	0.09	0.53	0.20	0.17	0.009	0.34	1.34
3.	Summit Pit										
	Dried	36.00	0.015	46.00	0.09	0.54	0.20	0.17	0.009	0.34	
	Natural	34.50	0.015	45.40	0.09	0.54	0.20	0.17	0.009	0.34	

Anticipated Grades:	Iron	Phos	Silica	Sulphur	Moisture
Tilden Silica					
Dried	39.00	0.040	42.30	0.010	
Natural	38.30	0.039	41.59	0.010	1.80
Tilden Low Phos.					
Dried	36.00	0.015	46.90	0.010	
Natural	35.50	0.015	46.24	0.010	1.40

f. Guaranteed Grade 1954:

	Grade	Iron	Phos	Sil	Mang	Alum	Lime	Mag	Sul	Loss	Moisture
1.	Tilden Silica										
	Dried	39.00	0.040	42.30	0.07	0.69	0.25	0.20	0.010	0.35	
	Natural	38.30	0.039	41.54	0.07	0.68	0.25	0.20	0.010	0.34	1.80
2.	Tilden Low Phos.										
	Dried	36.00	0.015	46.90	0.07	0.66	0.20	0.20	0.010	0.30	
	Natural	35.50	0.015	46.24	0.07	0.63	0.20	0.20	0.010	0.30	1.40

4. LABOR AND WAGES:

a. Personnel used in loading ore from stockpile and in the bit dressing shop were taken from other mines, thereby eliminating the need of a payroll.

5. GENERAL SURFACE:

a. Comments:

The Upper Peninsula Power Company completed the pole line for the extension of its power transmission line from the Tilden to the Hercules Powder Company plant. The pole line is south of present and future stocking areas.

6. OPEN PIT:

a. Stripping:

There were no stripping operations at the Tilden Mine during 1954.

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7. IDLE EXPENSE:

a. Detail of Expense:

1954 Total Winter and Idle Expense:

Month	Labor	Supplies	Total
January	$915.42	$622.20	$1,537.62
February	267.00	156.72	423.72
March	17.88		17.88
April	434.88	695.95	1,130.83
May	227.15	55.38	282.53
June	150.56	1,113.81	1,264.37
July	841.21	210.97	1,052.18
August	1,148.21	658.96	1,807.17
September	843.48	2,558.16	3,401.64
October	857.28	7,977.96	8,835.24
November	215.40	2,447.22	2,662.62
December	1,311.36	173.62	1,137.74
T O T A L	$4,607.11	$16,670.95	$21,278.06

Includes stockpile loading costs for the 1954 shipping season.

8. TAXES:

Description	1954 Valuation	1954 Taxes	1953 Valuation	1953 Taxes
Tilden Township-N½ of Sec. 26,47-27 320A	$125,000	$2,705.86	$190,000	$3,863.80
Personal Property, Equipment & Supplies	125,000	2,705.87	65,000	1,321.80
Total Tilden Mine	$250,000	$5,411.73	$255,000	$5,185.60

9. PERSONAL INJURY:

There were no compensable injuries at the Tilden Mine during 1954.

10. EQUIPMENT:

No new equipment was requisitioned for the Tilden Mine.

11. GENERAL:

Work of a very minor nature included the moving of the Tilden Bucyrus-Erie 120-B Electric Shovel to the Republic Mine. The new Bucyrus-Erie 54-B Electric Shovel originally scheduled for the Republic Mine was shipped to and placed into operation at the Tilden Mine.

In April, four of the Tilden 15-ton Euclid Trucks were sold to L.G. Everist, Inc. of Sioux Falls, South Dakota.

The churn drill bit dressing equipment was operated occasionally to take care of the Ohio Mine churn drill bit requirements.

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1. GENERAL:

The Bunker Hill Mine operated on a 5-day schedule from January 1st to April 4, 1954, with mining operations performed by a complete 2-shift crew and a small hoisting crew on the third shift. During the remainder of the year, the mine operated on a 4-day, 2-shift basis, with a 25% reduction in the working force occurring on May 15, 1954.

Production from the Bunker Hill Mine in 1954 totaled 440,000 tons. This is a decrease of 29.0% of the 620,080 tons produced at the Athens Mine in 1953. The decrease was the result of a 25% reduction in the working force and a 20% reduction in the operating schedule.

The average analysis of the product was improved over the 1953 production. The average dry iron analysis in 1953 was 58.01 and in 1954 it was 58.29. The analysis continued low primarily because mining on 10th Level was nearing completion and mining on 12th Level had not commenced in the larger high-grade ore bodies.

The cost of production for 1954 increased by $1.015 over that of 1953. In 1953, the cost of production was $3.650 per ton and in 1954, it had increased to $4.665. This increase in cost was primarily due to three factors. The 1954 production was in the less favorable structural areas where the height of ore was limited and a heavy wet condition existed. Excessive repair was required to maintain the working places. The second factor was the reduced work schedule. The longer idle periods on weekends allowed packing of the ore in the mill openings and more effort was expended in getting the ore to move in the block cave areas. The third factor was the increased cost of labor and material. As the mining emphasis is shifted to the larger 12th Level ore areas, the mining conditions will improve and should be reflected in a lower cost per ton.

The ore reserve picture for the Bunker Hill Mine continues to be good. During 1954, the total increase for the Mine was 981,719 tons, of which 925,904 was in the Bunker Hill property. The total remaining reserve based on the tax estimate figure is 4,640,321 tons, of which 3,219,563 tons are in the Bunker Hill.

The labor-management relationship showed a definite improvement over 1953, even though a larger number of grievances were submitted. In 1954, 13 grievances were processed; of this number, 8 were dropped by the Union, 2 were adjusted by the Company, 1 arbitration was won by the Company, and 1 by the union. Another grievance in Step 4 is being carried into 1955.

The change over from the hoisting and surface facilities of the Athens to the Bunker Hill was made on January 1, 1954. As with most new operations, the Bunker Hill experienced trouble during the early part of the year. For a short period in February, the ore hoisting was shifted to the Athens while liner plates were installed in the Bunker Hill Shaft. One compressor was transferred from the Athens to the Bunker Hill.

A study of the surface and the possibility of draining the overburden was explored. As a result, 5 holes were drilled on surface, and four of these were converted to water production wells.

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1. GENERAL: (Cont'd.)

Mining was concentrated, for the major part, above the 10th Level elevation. Sub-level caving was carried on in the eastern portion of the ore body above 6th Level. In the Bunker Hill and the western portion of the Athens ore bodies on 10th Level, the mining was confined to areas where the height of ore was limited by the plunge of the iron formation capping. These areas were heavy and wet and required a considerable amount of maintenance.

Rock development was done on the 10th, 12th, and 14th Levels. On 10th Level, a new connection was being driven through the center of the Athens Dike to serve the west end of the 10th Level. On 12th Level, the main line was advanced to the west, 2300 cross-cut was completed, and the 2400 cross-cut was advanced through the north ore body. On 14th Level the trenches were completed and work on the combined haulage-conveyor drift was progressing at a rapid pace.

The exploration was chiefly concerned with the outlining of the ore above 10th Level in the area south of the Athens Dike. Drilling has shown that a significant reserve will be available in this area.

The tax valuation for the Athens Mine decreased slightly because of depletion of reserves. The valuation of the Bunker Hill Mine increased due to increased reserves, and also due to acquisition of the Negaunee Shaft facilities. For the Athens the reduction in taxes for 1954 over 1953 was $9,283.16, while the increase for the Bunker Hill for the same period was $30,528.22.

There was a considerable decrease in the number of lost-time accidents in 1954 over 1953. During 1954, the number of lost-time accidents was 8 as compared to 20 in 1953. The reduction in accidents is a credit to the vigilance and the increased safety consciousness of the supervisory personnel.

2. PRODUCTION:

Production by Grades and Months:

Month	Athens	Mitchell	Bunker Hill	Total	Rock
January	24,598	11,927	7,018	43,543	6,655
February	24,753	13,172	6,191	44,116	5,695
March	22,199	22,463	7,154	51,816	7,220
April	21,819	9,503	7,047	38,369	6,505
May	13,972	13,064	7,466	34,502	4,540
June	20,416	10,195	4,552	35,163	5,275
July	9,827	6,086	1,282	17,195	1,990
August	13,111	11,740	8,763	33,614	4,415
September	17,765	5,989	9,554	33,308	5,130
October	19,716	4,551	10,638	34,905	5,240
November	21,135	2,960	11,827	35,922	4,380
December	22,687	2,683	12,177	37,547	6,340
Total	231,998	114,333	93,669	440,000	63,385
Stockpile Overrun	-------	-------	------	-------	------
Total 1954	231,998	114,333	93,669	440,000	63,385
Total 1953	296,430	185,451	138,199	620,080	25,103
Increase					38,282
Decrease	64,432	71,118	44,530	180,080	

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2. PRODUCTION: (Cont'd.)

Shipments:

Grades:	Pocket	Stockpile	1954 Total	1953 Total
Athens	39,961	37,274	77,235	275,154
Mitchell Lease	39,173	50,040	89,213	172,422
Bunker Hill	23,767	10,791	34,558	126,191
Total	102,901	98,105	201,006	573,767
Total Last Year	286,045	287,722	573,767	
Increase in Shipments				
Decrease in Shipments	183,144	189,617	372,761	

Ore Statement:

	Athens	Mitchell Lease	Bunker Hill	1954 Total	1953 Total
On Hand January 1, 1954	53,570	30,012	19,787	103,369	57,056
Out Put for Year	231,998	114,333	93,669	440,000	585,035
Stockpile Overrun					35,045
Total	285,568	144,345	113,456	543,369	677,136
Shipments	77,235	89,213	34,558	201,006	573,767
Balance on Hand	208,333	55,132	78,898	342,363	103,369
Increase in Output					
Decrease in Output	36,090	67,836	41,109	145,035	
Increase in Ore on Hand	154,763	25,120	59,111	238,994	
Decrease in Ore on Hand					

Operating Schedule:

Year	Days Per Week Mine Operated
1954	5 Days January to April 4: 4 Days April 5 thru December.
1953	5 Days Entire Year.
1952	6 Days thru July: 5½ Days thru November 15: and 5 Days Thru December.
1951	6 Days Entire Year.
1950	5 Days January thru July: 6 Days August thru December.

Division of Product by Levels:

	1954 Tons	1954 Percent	1953 Tons	1953 Percent
6th Level	119,275	27.1%	250,180	40.3%
7th Level	48,248	11.0%	2,767	0.5%
10th Level	217,292	49.4%	367,133	59.2%
12th Level	55,185	12.5%		
Total	440,000	100.0%	620,080	100.0%

Production Delays:

Date	Hours		Tons Lost
January 11	36	Main Power Cable Failure	3600
January 14	10	Lily Control Repair	1000
	40½	Misc.	4050
Total:	86½		8650

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3. ANALYSIS:

Average Mine Analysis on Output:

Grade:	Tons	1954 Iron	Phos.	Sil.	Sul.	Tons	1953 Iron	Phos.	Sil.	Sul.
Athens-Bunker Hill & Mitchell Lease	440,000	58.29	.116	8.93	.006	620,080	58.01	.117	9.01	.011

Average Analysis of Shipments:

Grade	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist.
Athens-Bunker Hill & Mitchell	58.13	.117	9.48	.44	3.06	.47	1.11	.008	.166	13.16
Natural	50.48	.102	8.23	.38	2.66	.41	.96	.007	.144	13.16

Average Analysis of Ore In Stock:

Grade	Tons	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist.
Athens-Bunker Hill at Athens	88,704	58.06	.119	9.90	.45	3.05	.52	1.01	.010	1.60	12.90
Natural		50.57	.104	8.62	.39	2.66	.45	.88	.009	1.39	12.90
Mitchell at Athens	14,340	58.33	.137	9.20	.45	3.05	.50	1.01	.010	1.60	12.90
Natural		50.81	.119	8.01	.39	2.66	.44	.88	.009	1.39	12.90
Athens at Bunker Hill	239,319	58.21	.114	9.02	.44	3.06	.47	1.11	.005	1.76	13.16
Natural		50.55	.099	7.83	.38	2.66	.41	.96	.004	1.53	13.16

4. COST OF OPENING, EQUIPPING, DEVELOPING AND OPERATING:

There were three active E & A's at the Bunker Hill during 1954. E & A CC-345 which covered the rehabilitation of the Bunker Hill Shaft, E & A CC-619 which is the master E & A, and E & A CC-623, which covers the underground diamond drilling program.

Reference	Prior Year Expenditures	1954 Expenditures	Total Expenditures
E & A CC-345	$3,311,758	$ 50,488	$3,362,246
E & A CC-619	---------	464,717	464,717
E & A CC-623	---------	51,823	51,823

Comparative Mining Costs:

	1954	1953	Increase	Decrease
Product	440,000	620,080		180,080
Underground Costs	2.994	2.681	.313	
Surface Costs	.571	.333	.238	
General Mine Expense	1.100	.636	.464	
Cost of Production	4.665	3.650	1.015	
Depreciation	.211	.029	.240	
Taxes	.041	.165		.124
Loading & Shipping	.046	.087		.041
Administration, Cleveland Office, & Hoisting Fee	.103	----	.103	
Total Cost at Mine	5.066	3.873	1.193	

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4. COST OF OPENING, EQUIPPING, DEVELOPING AND OPERATING: (Cont'd.)
Comparative Mining Costs: (Cont'd.)

	1954	1953	Increase	Decrease
Budget: Estimated Cost at Mine	5.353	4.736	.617	
Number of Shifts & Hours	58-1/8 Hr. 179-2/8 Hr.	1-1/8 Hr. 253-2/8 Hr.	57	74
Number of Days Operated	237	254		17
Average Daily Product	2115	2441		326

Proportion of Labor & Supplies:

Cost of Production	1954	Percent	1953	Percent	Increase	Decrease
Labor	3.244	69.54	2.655	72.73	.589	
Supplies	1.421	30.46	.995	27.27	.426	
Total:	4.665	100.00	3.650	100.00	1.015	

Detailed Cost Comparison:
Days and Shifts:

Year	Days Mine Operated	Shifts & Hours	Men Employed	Total Shifts Worked
1954	237	58-1/8 Hr. 179-2/8 Hr.	312	416
1953	254	1-1/8 Hr. 253-2/8 Hr.	344	507
Increase		57-1/8 Hr.		
Decrease	17	74-2/8 Hr.	32	91

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4. COST OF OPENING, EQUIPPING, DEVELOPING AND OPERATING: (Cont'd.)
Detailed Cost Comparison: (Cont'd.)
Cost of Production:

	1954		1953	
Underground Costs:	Amount	Per Ton	Amount	Per Ton
Development	$ 152,000.74	$ .346		
Mining	481,923.48	1.096		
Tramming	273,626.27	.621		
Ventilation	35,225.81	.080		
Pumping	69,639.52	.158		
Compressors and Air Lines	72,431.76	.164		
Underground Superintendence	83,543.54	.190		
Maint: Pockets and Chutes	5,310.15	.013		
" Mining Equipment	74,061.12	.168		
" Levels and X-Cuts	50,203.32	.114		
" Shaft	19,217.72	.044		
Total Underground Cost	$1,317,183.43	$2.994	$1,675,333.65	$2.701
Surface Costs:				
Hoisting	90,656.20	.206		
Crushing and Screening--Surf.	11,001.72	.025		
Stocking	45,961.15	.105		
Timber Yard	33,376.27	.076		
Dry House	19,846.62	.045		
Policing	22,739.02	.051		
General Surface	18,245.37	.041		
Maint: Headframe Bldg. & Equip.	2,503.39	.006		
" Other Mine Buildings	6,515.55	.015		
" Idle & Abandoned Properties	471.20	.001		
Total Surface Cost	$251,316.49	$ .571	$193,987.78	$ .313
General Mine Expenses:				
Geological Department	3,294.16	.008		
Mining Engineering Department	26,877.66	.061		
Mech. and Elect. Eng. Dept.	22,895.48	.052		
Safety Department	5,319.92	.012		
Research Laboratory	1,385.33	.002		
Analysis & Grading	35,061.22	.079		
Telephones & Safety Devices	26,775.98	.060		
Welfare - Local & General	3,256.29	.008		
Special Expense-Pensions & Allowances	14,620.95	.035		
Ishpeming Office	55,054.33	.125		
Mine Office - Supt. & Clerks	58,440.19	.133		
Central Warehouse Overhead	18,516.10	.042		
Insurance	42,628.01	.096		
Personal Injury	9,776.64	.023		
Vacation Pay - Current Year	72,242.91	.164		
" " - Prior Year Adj.	7,502.71	.017		
Holiday Allowance	29,468.37	.067		
Social Security Taxes	39,177.36	.089		
Pensions - Current Cost Wage Earners	26,840.00	.061		
Total General Mine Expenses	$484,128.19	$1.100	$394,132.04	$ .636
Cost Of Production	$2,052,628.11	$4.665	$2,263,453.47	$3.650

Note: Detail of charges to particular accounts was omitted from 1953 comparison because of changes made in revising the cost sheet which was used during 1954.

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5. ESTIMATE AND ANALYSIS OF ORE RESERVES:

Developed Ore:

In the Athens property of the total reserve, which is based on the figures submitted to the Michigan State Tax Commission, the reserve between the 4th and 10th Levels and adjacent to the 2300 cross-cut on 12th Level is considered developed ore. The remaining ore is considered undeveloped.

In the Bunker Hill, the ore reserve above 10th Level east of the 2500 west coordinate is considered developed ore and the remainder is considered undeveloped.

The ore reserves in the following table are based on the figures submitted to the Michigan State Tax Commission.

	Athens	Mitchell Lease	Bunker Hill	Total
Ore Reserves - Dec. 31, 1953	1,483,016	228,258	2,387,328	4,098,602
Ore Production - 1954	231,998	114,333	93,669	440,000
Ore Reserves - Dec. 31, 1954	1,257,842	162,916	3,219,563	4,640,321
Tonnage Proved in 1954	6,824	48,991	925,904	981,719
4th Level to -500 Sub	12,797	4,807		17,604
-500 Sub to 6th Level	103,811	133,323		237,134
6th Level to 7th Level	12,216	73,913		86,129
7th Level to 8th Level	------	------		------
8th Level to 9th Level	4,745			4,745
9th Level to 10th Level	199,722		784,069	983,791
10th Level to 12th Level	1,069,647		1,729,369	2,799,016
12th Level to 14th Level	99,569		1,065,158	1,164,727
Below 14th Level			57,539	57,539
Total Gross as of July 31, 1954	1,502,507	212,043	3,636,135	5,350,685
Less 10% for Mining & Rock	150,251	21,204	363,613	535,068
Net Total As Of July 31, 1954	1,352,256	190,839	3,272,522	4,815,617
Less Production July 31, 1954 to December 31, 1954	94,414	27,923	52,959	175,296
Net Total on December 31, 1954	1,257,842	162,916	3,219,563	4,640,321

Expected Average Natural Analysis of Ore Reserves:

The following analyses are based on the figures submitted to the Michigan State Tax Commission:

Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist.
50.50	.100	8.00	0.39	2.75	0.36	0.80	0.011	1.40	13.40

6. LABOR AND WAGES:

Labor Relations:

During 1954, there were two grievances advanced into Step 2, four into Step 3, five into Step 4, and two went to arbitration. The two Step 2 grievances were dropped by the Union. Of the four advanced into Step 3, two were dropped by the Union and two were adjusted by the Company. The five

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6. LABOR AND WAGES: (Cont'd.)
Labor Relations: (Cont'd.)

grievances carried into Step 4 were all dropped by the Union with the exception of one, which was carried over into 1955. One arbitration was won by the Company involving the discharge of one employee for losing time, and the other arbitration involving a job classification during the retroactive pay period was decided in favor of the Union.

Although there was an increase in the number of grievances processed in 1954 as compared to 1953, the labor relations at the end of the year were considerably better than they have been in the past. This has come about through a better understanding of management's labor problems by some of the more influential members of the Grievance Committee. As might well be expected, there was some confusion immediately following consolidation of the Athens Mine and Negaunee Shaft labor groups.

Employment:

The average number of statistical employees in 1954 was 312 as compared with 344 in 1953. The decrease was due to a reduction from 5 to 4 days on April 5th and a 25% reduction in the number of men on May 17th.

There were 120 separations during the year 1954 -- 15 retired, 2 deaths, 2 quit, 15 transferred, 2 discharged, and 84 laid off. There was one man hired and one transferred back to the Bunker Hill. The 15 transferred were men who went back to their parent mine after the Bunker Hill was ready for production as per agreement made when shaft sinking commenced.

Number of Men Beginning of Year	406
Added During Year	2
Separations	120
Total End of Year	288

The following tables give data pertinent to paid vacations and holidays.

Vacations - 1954

	Number of Men	Number of Hours	Amount	Rate Per Hour
One Week	90	3604½	$ 7,358.63	$2.04
Two Weeks	140	11200	25,620.36	2.29
Three Weeks	148	17760	39,263.92	2.21
Total	378	32564½	$72,242.91	$2.22

Paid Holidays - 1954

	Number of Men	Number of Hours	Amount	Rate Per Hour
New Years Day	329	2616	$ 5,637.90	$2.155
Memorial Day	264	2112	4,515.04	2.138
Fourth of July	254	2032	4,754.80	2.340
Labor Day	255	2040	4,594.04	2.252
Thanksgiving	251	2008	4,568.04	2.275
Christmas Day	244	1952	4,498.56	2.305
Total	266½	12760	$28,568.38	$2.239

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6. LABOR AND WAGES: (Cont'd.)

Statement of Wages:

Average Wages Per Day	1954	1953	Increase	Decrease
Surface	$ 17.28	$ 16.68	$.60	
Underground	20.68	19.70	.98	
Total	$ 19.88	$ 18.98	$.90	
Average Wages Per Month				
Surface	$299.46	$352.95		$53.49
Underground	358.38	416.85		58.47
Total	$344.52	$401.62		$57.10
Average Days Worked Per Month				
1954 - 17.33				
1953 - 21.16				
Tons Per Man Per Day				
Surface	21.10	32.43		11.33
Underground	9.71	9.89		.18
Total	6.65	7.58		.93
Labor Cost Per Ton				
Surface	.851	.514	.337	
Underground	2.116	1.992	.124	
Total	2.967	2.506	.461	

7. SURFACE:

Athens Shaft:

The surface buildings and the Athens Shaft were abandoned on January 1, 1954. After the change-over to the Bunker Hill, the Athens Shaft and building openings were boarded up to prevent entrance and possible damage to the stored equipment or the buildings.

Hoisting operations were shifted from the Bunker Hill to the Athens Shaft on February 15th and continued until the end of the month while liner plates were installed at the loading stations in the Bunker Hill Shaft. Subsidence in the surface area and buildings around the Athens Shaft continued at a fairly uniform rate throughout the year.

Bunker Hill Mine:

Throughout the month of January, numerous delays were experienced in the surface flow sheet and engine house. On January 11th, the main power cable failed and production did not resume until January 13th. In all, 36 production hours were lost because of the power failure.

The surface subsidence surveys continue to show some movement along the main railroad right-of-way. The subsidence survey was extended along the north and south boundries of the Bunker Hill so that closer watch could be maintained on the rate of subsidence.

7. SURFACE: (Cont'd.)

Bunker Hill Mine: (Cont'd.)

The Bunker Hill Mine embarked upon a study of the ground water in the over-burden near the cave area. The purpose of the study was to determine if the surface water could be prevented from entering the cave. The first step in the project was a geophysical study, by seismic method, of the ledge topography. The seismic study confirmed the existence of a northwest trending trough.

This trough was tested by five churn drill holes drilled on a northeast-southwest line. Tests indicated that four of the holes could be made into production wells. Pumping in the first well started on September 3, 1954, and shortly thereafter pumps were installed in the other three wells. The maximum production was 550 g.p.m. With the continued drawdown, the rate of production has decreased. The drawdown in the observation well is continuing and it indicates that more water is being pumped than normally flows through the area.

8. UNDERGROUND:

Mining and Development:

Above the 6th Level, mining operations during 1954 consisted of sub-level caving in the Athens and Mitchell Lots and development for block caving in the Mitchell Lots. Mining on the -525 sub by sub-level caving was completed, while on the -525 sub it reached its last stages with only one drift remaining to be caved.

After a thorough study of the sub-level caving method in the 6th level areas, it was decided that the cost of mining, although considerably less than the old top-slicing method, was prohibitive. Because of this, the remaining ore above 6th Level, with the exception of a small area on the east end of the ore body, will be mined by block-caving from circular steel drifts. At the end of the year, development of the western portion of this area with four transfer drifts was underway with full production slated for the early part of 1955.

On 7th Level, mining of the block cave adjacent to the old top-slicing workings was completed. A large transfer drift was driven on 7th Level from which experimental mining with the three-foot diameter rotary auger will be conducted in 1955.

In the Athens property above 10th Level, mining of the south ore body was completed by sub-level caving in the east end and block caving over 1500 cross-cut. Large volumes of water were encountered in the block caves, causing several mud runs. In the north ore body, mining of the last block cave area, consisting of three circular steel drifts, neared completion at the end of 1954. Mining of the pillars left between the block caves, termed scramming, was carried on in both the north and south ore bodies. Only one small area in the east end of the north ore body remains to be mined in the Athens property on 10th Level. This will be mined in the early part of 1955.

A new connecting drift between 1000 and 1500 cross-cuts, to replace the present main line drift, was started during the year. The present drift, which is relatively close to the north ore body, requires excessive maintenance, and once block caving commences in the north ore body on 12th Level it will be impossible to keep the drift open for tramming.

8. UNDERGROUND: (Cont'd.)
Mining and Development: (Cont'd.)

A new main ventilation fan was installed on 10th Level in 1954. Its relocation made possible the elimination of two air doors, thus expediting the tramming of ore on 10th Level.

In the Bunker Hill property above 10th Level, block caving over 1600 and 1700 cross-cuts was completed and had reached its last stages over the western portion of 1500 cross-cut. Scramming over 1600 cross-cut was completed with favorable results. One block cave in the Bunker Hill area is worth particular mention. In an area that was mined out on three sides, cut off by a fault zone on the fourth side, and had always been plagued by weight and water, a much better recovery than had been anticipated was realized. Due to a very carefully controlled draw, dilution in the block was practically nil.

On 12th Level, main level drifting progressed with two drifting contracts until the advent of the 4-day week in April, when it was reduced to one. During the year, 2300 cross-cut was completed, the north main line drift was extended 150 feet past the Athens-Bunker Hill property line, and approximately half of 2400 cross-cut was driven.

Mining operations on 12th Level commenced during the year in the Athens property. Two block caves were developed over 2300 cross-cut in the south ore body. This area is complicated by small dikes and an unusual bulge in the Athens Dike, making it a doubtful one as far as grade and recovery are concerned. Sub-level caving was tried in the east end of the south ore body, but the results were not too favorable costwise. The remaining ore in the east end will be mined by a modified system of block caving. In the north ore body, development of two block cave areas was started in the last quarter of 1954 and will be in production in early 1955.

On 14th Level, plat development was completed with the stripping and roof bolting of the skip plat, and the west main sump was driven and concreted.

Development of the 14th Level conveyor system, which will handle 10th, 12th, and 14th Level ores, commenced during 1954. Ore from 10th and 12th Levels will be dropped to 14th Level through ore passes and trammed to the shaft on a 30" conveyor belt. The main line drift between the 14th Level plat and the beginning of the large conveyor-haulage drift was completed, and an advance of 940 feet made in the latter. The sump-cleanout drift was extended to a point under the inclined portion of the conveyor drift to develop the east end, or discharge end of the conveyor system.

Liner plates in the Bunker Hill Shaft at the loading stations on 6th, 10th, 12th, and 14th Levels were installed in February and March of 1954. As expected, the decrease in the amount of spillage when the skips are loaded has resulted in less maintenance on the skips and in the shaft and less wet ore hoisted from the skip pit.

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8. UNDERGROUND: (Cont'd.)

Mining and Development: (Cont'd.)

With the exception of one small pump on 5th Level, the installation of the new automatic pumps was completed in 1954, and all the mine water is now being pumped to surface by the automatic system. The water between 2nd and 5th Levels, which will be handled by the pump yet to be installed, is presently draining to the 6th Level sump from where it is pumped to 1st Level.

The following is a resume of the main level drifting done during 1954:

Level	Ore Drift	Rock Drift	Total
10th Level		178	178
12th Level	178	1741	1919
14th Level		1703	1703
	178	3622	3800

Exploration:

Athens:

Exploration in the Athens property was limited to exploration by drifting incidental with mining and development and one short diamond drill hole.

Routine mapping of the mining places did not disclose any significant changes in the Athens structure.

Drifting on the 12th Level main line proved the existence of a northwest-southeast fault, the north side being the down dropped side. The 14th Level drift is being driven without support in hard black slate and dense graywacke. In some places support by roof bolting was necessary because of the intersecting joints. In another instance, roof bolts were used at a lithological contact because separation occurred between the different rock types.

Bunker Hill:

Drilling continued at the reduced rate established in the latter part of 1953. During 1954 one machine was used to explore for ore along the 2400 W. and the 2800 W. northsouth sections. The area along the south boundary of the Bunker Hill property was explored from the Arctic parcel along the 3850 S. east-west section. Eight holes were drilled in the area between the 2200 W. and the 2800 W. With the exception of two holes drilled along the 2800 W., they explored the area above 10th Level south of the Athens Dike.

The holes, #15 and #35, were drilled for other purposes than ore exploration: hole #15 was re-entered and extended to check the material in the vicinity of the proposed 14th Level crusher; and hole #35 was drilled from the south end of the sumps on 14th Level to the 12th Level drift south of the plat as a water drain. Previously the mine water was carried to a pipe near the shaft in an open ditch and then piped to 14th Level. Considerable leakage around the plat and into the trench was experienced. The 3-7/8" hole has alleviated the condition very successfully.

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8. UNDERGROUND: (Cont'd.)
Exploration: (Cont'd.)
Bunker Hill: (Cont'd.)

In the table immediately below is shown the amount of ore cut and the total footage drilled during 1954.

1954 - Hole Numbers	First Class Ore	Footage Drilled	
Bunker Hill Holes:			
15	exploration for 14th Level Crusher	125'*	
32	104	219	
33	45	385	
34	235	380	
35	drain hole between 14th & 12th Levels	207 *	
36	62	460	
37	37	352	
Arctic Holes:			
1	121	704	
2	118	522	
3	287	971	
	1009	3992	footage drilled for ore exploration
*Footage not included in "footage drilled for ore exploration".		332	Holes 15 and 35 -
		4324	- Total footage drilled

Exploration by diamond drilling in the Bunker Hill was confined almost entirely to the portion of the new south ore body which lies above a north-west dipping intrusive.

2400 W. Section:

The 2400 W. section was explored after drilling from the Arctic Parcel and on the 2800 W. section indicated that the ore was lying on a relatively flat-lying intrusive. Holes 36 and 37 were drilled from the 1700 cross-cut as up holes, due south. Apparently these holes are very near the area of fault intersection. They confirmed the nature of the structure.

2800 W. Section:

The exploration south of the Athens Dike along the 2800 W. section was designed to test for the type of structure cut by Hole #21 which was drilled during 1953. Hole #32 was drilled south at -52° to check for the dip of the footwall while Hole #33 was drilled south -27° to check for the height of ore. These holes indicated the presence of a new structure along the south boundary of the Bunker Hill. Hole #34 completed the present exploration of this section. This hole was drilled due south at -85° to check for depth of ore. It was stopped at 14th Level elevation in ore.

3850 S. Section:

Further exploration of the new south structure was conducted from the Arctic 4.57 Parcel. Arctic Holes 1, 2, and 3 were drilled to explore the Bunker Hill. These holes cut ore above the relatively flat intrusive and confirmed the eastward extension of the ore which was cut along the 2800 W. section.

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8. UNDERGROUND (Cont'd.)

Statement of Timber Used:

	Amount - 1954	Amount - 1953
Cribbing	$ 3700.55	$ 5950.44
Stulls	13024.60	27727.22
Lagging	10142.01	15956.40
Poles	6187.61	12398.82
Steel H-Beams	53184.02	27510.25
Circular Steel Sets	11015.35	28448.15
Total	$97254.14	$117991.28

Total Cost of Timber, Lagging, Poles, Etc:

Year	Amount	Per Ton
1954	$ 97,254.14	.2210
1953	117,991.28	.1903
1952	69,794.67	.1404
1951	69,080.92	.1097
1950	64,244.24	.1050
1949	68,774.33	.1250
1948	79,243.23	.1564
1947	78,082.59	.1537
1946	53,734.65	.1463
1945	72,844.22	.1661

Explosives:

STATEMENT OF EXPLOSIVES USED DURING 1954

	1954		1953	
	Quantity	Amount	Quantity	Amount
Total Powder Used	132,576 lbs.	$23,620.73	209,475 lbs.	$35,609.52
Total Caps, Fuse, etc. Used		15,504.19		17,267.88
Total		$39,124.92		$52,877.40
PRODUCT		440,000		620,080
Pounds Powder Per Ton of Ore		.3013		.3374
Tons of Ore Per Pound Of Powder		3.3188		3.3742
Cost Per Ton For Powder		.0537		.0574
Cost Per Ton For Fuse, Caps, etc.		.0352		.0278
Cost Per Ton For All Explosives		.0889		.0852

Pumping:

The number of gallons pumped per minute during 1954 is a total of the water pumped from both the Athens and Bunker Hill. For comparsion the tables below are a total of Athens and Negaunee Shaft water.

Month	1954	1953	1952	1951	1950
January	1115	1341	1788	1423	1436
February	1083	1361	1650	1307	1427
March	1060	1351	1567	1249	1387

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8. UNDERGROUND (Cont'd.)
Pumping (cont'd.)

Month	1954	1953	1952	1951	1950
April	1150	1395	1509	1288	1408
May	1150	1457	1623	1497	1623
June	1234	1541	1505	1513	1830
July	1191	1583	1488	1598	1857
August	1238	1740	1487	1693	1409
September	1091	1598	1282	1693	1710
October	1164	1551	1307	1748	1537
November	1142	1498	1399	1806	1532
December	1129	1526	1306	1758	1560
Average	1146	1495	1493	1539	1593

The following statement shows the average number of gallons pumped for the past ten years:

Year	Gallons Per Minute
1954	1146
1953	1495
1952	1493
1951	1539
1950	1593
1949	1214
1948	1077
1947	1085
1946	1002
1945	1013

9. TAXES :

DESCRIPTION	1954 VALUATION	1954 TAXES	1953 VALUATION	1953 TAXES
ATHENS MINE				
Including Stockpiles, Supplies & Equipment as placed by State Tax Commission				
Real Estate	$1,270,000	$56,489.60	$1,825,000	$ 84,588.75
Personal Property	800,000	35,584.00	360,000	16,686.00
Collection Fee		930.74		1,012.75
TOTAL ATHENS MINE	$2,070,000	$93,004.34	$2,185,000	$ 102,287.50
Total Rented Buildings	1,040	46.72	35,140	1,645.05
TOTAL ATHENS IRON MINING COMPANY	$2,071,040	$93,051.06	$2,220,140	$103,932.55
BUNKER HILL MINE				
Realty as described and assessed by Michigan State Tax Commission 54.01 A.	$1,150,000	$51,152.00	$ 600,000	$ 27,810.00
Personal Property - State Tax Commission	155,000	6,894.40	-------	--------
Personal Property - Furnace Houses	5,050	224.62	5,050	234.07
Total		$58,271.02		$ 28,044.07
Collection Fee		582.71		280.44
TOTAL BUNKER HILL MINE	$1,310,050	$58,853.73	$ 605,050	$ 28,324.51

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10. ACCIDENTS AND PERSONAL INJURY:

The following table lists the compensable injuries for 1954:

Fatal	0
Time Lost Over 3 Months	1
Time Lost 1 to 3 Months	5
Time Lost Less Than 1 Month	2
Total	8

Acc. No.	Date of Accident	Name	Injury	Days Lost
1	5/17/54	Daniel Brady	General Body Contusion, Scalp Laceration	56
2	6/1/54	David Terzaghi	Strained left side	12
3	7/12/54	Emil Jarvi	Fractured toe	21
4	8/3/54	Walter Wertanen	Contusion right foot	90
5	8/10/54	Toivo Saari	Fracture Middle Finger Left Hand	32
6	8/19/54	Alfred Denofrio	Crushed left hand	98
7	10/27/54	Joseph Pepin	Fracture left heel	80
8	11/29/54	John Lahti	Fracture vertebra	35
	Total Days Lost			424

11. POWER:

The Cleveland Cliffs Iron Company Electric Power Department generates the power and the Upper Peninsula Power Company distributes it over their transmission lines. The average cost per kilowatt hour in 1954 was $.00946 as compared to $.0154 in 1953.

The rate per Kilowatt hour is determined by dividing the total operating cost of the Cleveland Cliffs Iron Company Electric Power Department by the total kilowatt hours sold and charging each consumer proportionately. To this is added a wheeling charge by the Upper Peninsula Power Company for distributing the power to the mine.

The following table lists the costs of power for 1954:

Hoisting	$ 15,527.23
Compressors	32,249.41
Electric Haulage	12,835.23
Pumping	46,253.45
Ventilation	16,374.82
Dry House	481.27
#31 Power Shovel	144.76
Shops	182.43
Surface	116.73
Miscellaneous	847.72
Total	$125,013.05

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1. GENERAL

The production for 1954 was 237,700 tons or an average of 1,137 tons per day, as compared with a production of 350,700 tons in 1953 or an average of 1,403 tons per day. The tons per man per day was 5.65, as compared with 6.03 in 1953. The total cost per ton was 5.359, as compared with a budget estimate of 5.409. It is interesting to note that the average daily production decreased 19%, while the total output per man was reduced by about 6% and the total cost per ton at the mine increased 10%. Thus, despite the general cutback and the gradual approach of exhaustion, overall efficiency has improved.

During the year, there was a general reduction in production, labor force and the work week. On April 5, the work schedule was cut from 5 to 4 days per week. On May 15, the labor force was reduced by 50 men, resulting in a 37½% cutback in production contracts and a sharply increased overhead expense. On July 1, a general wage increase of 5¢ per hour and additional fringe benefits were made to all hourly employees.

In 1954, a considerable amount of exploration and development work were carried out on the 7th and 8th levels in the east deposit. Several ore horizons were cut by the new drifts on each level; however, past experience in the east deposit indicates that the extent of ore cannot be determined until actual mining takes place. Such a condition makes forecasting of production and reserves very difficult. Because mining operations are at or very near the footwall with wild lenses of iron formation extending into the ore, it is difficult to plan development work to keep pace with mining operations. The result is an uneven production from month to month, with periods of high developing costs coinciding with the periods of low production.

The product analysis for 1954 was good, with the final grade well above the analysis estimate. As mining operations become more concentrated in the east deposit the sulphur content will continue to be less, with a slight improvement in the iron units.

2. PRODUCTION

a. Production by Grade and Months

Month	Jackson Strip	Rock
January	21,919	1,952
February	25,762	900
March	33,243	2,084
April	19,850	2,692
May	18,470	2,636
June	23,001	2,872
July	9,701	952
August	21,274	1,720
September	18,396	2,184
October	15,967	2,232
November	13,851	2,444
December	16,266	1,320
Total 1954	237,700	23,988
Total 1953	350,700	15,400
Increase	-	8,588
Decrease	113,000	-

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2. PRODUCTION (CONTINUED)

b. Shipments

	Pocket Tons	Stockpile Tons	Total Tons
Jackson Strip 1954	110,788	36,163	146,951
Jackson Strip 1953	202,384	147,238	349,622
Decrease	91,596	111,075	202,671

Shipments decreased 58% in 1954, and were 90,749 tons less than the product for the year. On December 31, 1954, there were 130,876 tons remaining in stock.

During 1954, there was no mining or product from the Cambria lease.

c. Ore Statement

	1954	1953
On hand Jan. 1, 1954	40,127	39,049
Output for year	237,700	342,603
Overrun	-	8,097
Total	277,827	389,749
Shipments	146,951	349,622
Bal. on hand Dec. 31, 1954	130,876	40,127
Increase in output	-	4,097
Decrease in output	104,903	-
Increase in ore on hand	90,749	1,078

Days per Week Operating

1954 - Five 2-8 hour shifts 1-1-54 to 4-5-54.
Four 2-8 hour shifts 4-5-54 to 12-31-54.

1953 - Five 2-8 hour shifts 1-1-53 to 12-31-53.

1952 - Six 2-8 hour shifts 1-1-52 to 5-1-52.
Five and one-half 2&3-8 hour shifts 5-1-52 to 11-15-52.
Five 2-8 hour shifts 11-17-52 to 12-31-52.

1951 - Six 2-8 hour shifts 1-1-51 to 12-31-51.

1950 - Five 2-8 hour shifts 1-1-50 to 8-28-50.
Six 2-8 hour shifts 8-28-50 to 12-31-50.

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2. PRODUCTION (CONTINUED)

d. Division of Product by Levels and Months

Month	6th Level	7th Level	8th Level	Total
January	-	5,595	16,324	21,919
February	211	9,661	15,890	25,762
March	1,489	12,152	19,602	33,243
April	1,028	8,399	10,423	19,850
May	-	7,176	11,294	18,470
June	-	6,422	16,579	23,001
July	-	3,555	6,146	9,701
August	-	7,778	13,496	21,274
September	-	6,718	11,678	18,396
October	-	5,430	10,537	15,967
November	-	4,180	9,671	13,851
December	-	6,857	9,409	16,266
Total 1954	2,728	83,923	151,049	237,700
Total 1953	-	47,006	303,694	350,700
Increase	2,728	36,917	-	-
Decrease	-	-	152,645	113,000

e. Production Delays

There were no major production delays in 1954.

3. COST OF OPENING, EQUIPPING, DEVELOPING, AND OPERATING

Comparative Mining Costs

	1954	1953	Increase	Decrease
Product	237,700	350,700	-	113,000
Underground Costs	3.418	3.259	.159	-
Surface Costs	.485	.346	.139	-
General Mine Expenses	.943	.693	.250	-
Cost of Production	4.846	4.298	.548	-
Depletion & Depreciation	.151	.196	-	.045
Taxes	.168	.156	.012	-
Loading and Shipping	.043	.063	-	.020
Rental-Shaft Facilities	.151	.103	.048	-
Total Cost at Mine	5.359	4.816	.543	-
Budget Est'd Cost per Ton	5.409	4.852	.557	-
No. of Shifts & Hours 1-8	-	2	-	2
2-8	209	248	-	39
No. of Days Operated	209	250	-	41
Average Daily Product	1,137	1,403	-	266

Proportion of Labor and Supplies

	1954	Percent	1953	Percent	Increase
Labor	3.716	69.3	3.286	68.2	.430
Supplies	1.643	30.7	1.530	31.8	.113
Total	5.359	100.0	4.816	100.0	.543

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3. COST OF OPENING, EQUIPPING, DEVELOPING, AND OPERATING

Detailed Cost Comparison

	1954		1953	
Days per Week	5 to 4-5-54 4 bal. of yr.		5	
Shifts and Hours	1-8 - 2-8 209		1-8 2 2-8 248	
Production, Tons	237,700		350,700	
Average Daily Production, Tons	1,137		1,403	
Number of Days Worked	209		250	
UNDERGROUND COSTS	Amount	Per Ton	Amount	Per Ton
Development	147,194.99	.619		
Mining	271,757.60	1.143		
Tramming	160,359.14	.675		
Auxiliary Hoisting	20,256.42	.085		
Ventilation	18,898.53	.080		
Pumping	37,594.25	.158		
Compressors and Air Lines	28,337.18	.119		
Underground Superintendence	64,294.03	.270		
Maint: Pockets and Chutes	6,587.37	.028		
" Mining Equipment	19,132.56	.081		
" Levels and X-Cuts	26,114.69	.110		
" Shaft	11,968.25	.050		
Total Underground Costs	812,495.01	3.418	1,143,102.17	3.259
SURFACE COSTS				
Hoisting	40,100.02	.169		
Stocking	20,265.22	.085		
Timber Yard	16,237.98	.069		
Dry House	9,093.29	.038		
Policing	14,058.65	.059		
General Surface	9,960.37	.042		
Maint: Headframe Bldg. & Equip.	1,621.27	.007		
" Other Mine Buildings	3,838.21	.016		
Total Surface Costs	115,175.01	.485	121,167.41	.346
GENERAL MINE EXPENSES				
Geological Department	5,261.86	.022		
Mining Engineering Department	10,219.93	.043		
Mech. and Elect. Eng. Dept.	4,506.73	.019		
Safety Department	3,026.38	.013		
Research Laboratory	628.09	.003		
Analysis & Grading - Laboratory	13,535.43	.057		
" " " - Shipping	2,777.03	.012		
Telephones & Safety Devices	19,280.19	.081		
Welfare - General	1,558.86	.007		
" - District	148.38	.001		
Special Expense - Pensions	44.85	.000		
" " - Retirements	2,441.56	.010		
" " - Legal	1,829.72	.008		
" " - Hygiene Clinic	2,858.69	.012		
" " - Employment Off.	736.02	.003		
Ishpeming Office	28,863.58	.121		
Mine Office - Supt. & Clerks	26,882.13	.113		
Central Warehouse Overhead	5,789.57	.024		
Insurance - Property	1,524.56	.006		
" - Group, Health & Life	8,927.29	.037		
" - Group Annuity	6,649.74	.028		
" - Catastrophe	2,049.16	.009		
Personal Injury - Comp. & Doctors	3,541.31	.015		
" " - Comp. Dept.	1,255.86	.005		
Vacation Pay - Current Year	41,171.70	.173		
" " - Prior Year Adj.	9,360.00	.039		
Holiday Allowance	16,621.80	.070		
Taxes - Unemployment Insurance	7,743.56	.033		
" - Old Age Benefit	13,619.99	.057		
Total General Mine Expenses	224,133.97	.943	243,107.60	.693
COST OF PRODUCTION	1,151,803.99	4.846	1,507,377.18	4.298

The card of accounts for cost procedure was revised in 1954, therefore comments regarding increases or decreases in various captions would not carry any real significance.

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4. ANALYSIS

a. Average Mine Analysis on Output

Iron	Phos.	Sil.	Sulph.
58.34	.095	9.28	.149

b. Average Analysis of Shipments (Dried)

Iron	Phos.	Sil.	Mang.	Alum.	Sulph.	Lime	Mag.	Loss	Moist.
58.43	.097	9.40	.22	2.22	.143	.71	.30	2.52	12.09

c. Average Analysis of Ore in Stock (Natural)

Iron	Phos.	Sil.	Mang.	Alum.	Sulph.	Lime	Mag.	Loss	Moist.
50.89	.084	8.54	.19	2.04	.147	.62	.26	2.39	12.09

d. Analysis of Straight Cargo Shipments

All ore shipped was mixed with other grades.

5. ESTIMATE AND ANALYSIS OF ORE RESERVES

The estimated ore reserves of the Cambria-Jackson Mine are located in the Jackson Strip only, and include ore of varying degrees of sulphur. Practically all the reserves, as shown below, are located in the east deposit adjacent to the Hartford fault, which influences the location of ore concentration.

Comparison of Production to Reserves

Reserves on Jan. 1, 1954	375,035
Production Jan. 1 to Dec. 31, 1954	237,700
Balance	137,335
Reserves as of Dec. 31, 1954	413,108
New Ore Developed	275,773

All of the ore developed in 1954 was found in the east deposit where the ore outlines are extremely irregular, thus an accurate estimate of reserves is difficult, and inclined to fall on the conservative side.

Developed Ore

Assumption — 12.00 cubic feet equals one ton.
10% deduction for loss in mining and rock.

Percentage of Bessemer — None.

	Sulphurous Ore		
Area	Negaunee	Ishpeming	Total
Between 6th and 7th levels	187,820	852	188,672
Between 7th and 8th levels	219,436	146,183	365,619
Gross as of July 31, 1954	407,256	147,035	554,291
Less 10% for Mining and Rock	40,726	14,703	55,429
Net Total as of July 31, 1954	366,530	132,332	498,862
Less Production 7-31-54 to 12-31-54	53,675	32,079	85,754
Net Total reported to Michigan State Tax Commission as of December 31, 1954	312,855	100,253	413,108

Expected Average Natural Analysis of Ore Reserves, Based on Tax Commission Figures

Iron	Phos.	Sil.	Mang.	Alum.	Sulph.	Lime	Mag.	Loss	Moist.
52.00	.079	7.79	.18	2.41	.131	.57	.30	2.50	12.40

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6. LABOR AND WAGES

Labor Relations

Labor relations between the mine management and the union grievance committee and employees have continued to be excellent. One formal grievance was filed and, because of its Company-wide importance in future filling of posted job vacancies, settlement was carried through to arbitration.

The following is a description of the grievance:

"There has been a vacancy at the Cambria-Jackson for Hoisting Engineer which has not been properly filled after job posting. This is a violation of Section IX of our basic agreement with the Company. I request that the Company put me on the job of Hoisting Engineer on the basis of the Seniority section of our 1952 Agreement with the Company."

Dated: May 5, 1954. (Signed) Dominic Cardone.

An arbitration decision on this grievance was favorable to the Company. It involved selection of a hoisting engineer to fill a vacancy wherein one of the applicants with the least seniority was chosen for the job. He had had a number of years experience at the Princeton Mine while Cardone, the grievant, had worked as a pumpman with utterly no experience as a hoisting engineer. The Union assumed the position that Cardone's ability to learn the job was equal and that he had been provided with no opportunity to do so. A number of previous arbitration decisions have negated this stand. Mr. Hyman Parker, presiding at the hearing stated, in effect, that it is immediate ability, not potential ability, that should be the governing factor in such a selection.

The craft job and job classification program, as adopted in 1952, appears to be working very satisfactorily, and those men in this division are regularly improving their skills. These men are moved to higher job classes as they become qualified. The average job class as of January 1, 1954, was 10.28, and on December 31, 1954, was 10.46.

As of December 31, 1954, there were 163 men on the payroll, as compared with 225 the preceding year. In anticipation of reduced production during 1954, 6 men were laid off in January, in addition to the 50 men who were laid off in May. Further reductions were made as men quit, retired, or died, and were not replaced.

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6. LABOR AND WAGES (CONTINUED)

The following table is a breakdown of the employment record:

Employment

Number of men beginning of year	225
Added during the year	5
Separations	67
Total end of year	163
Average number of men as per December Labor Statement	195

Accessions	
Straight hires	1
Returned from military service	4
Total	5

Separations	
Laid off	56
Retired	4
Deceased	3
Accepted other employment	2
Returned to school (temporary hires)	2
Total	67

Paid Holidays

	Number of Men	Amount
New Year's Day	201	3,445.60
Memorial Day	149	2,582.52
Independence Day	147	2,671.76
Labor Day	151	2,706.44
Thanksgiving	147	2,637.56
Christmas	146	2,577.92
Average and Total	157	16,621.80

Vacations

Year	Amount
1954	41,171.70
1953	44,245.11

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6. LABOR AND WAGES (CONTINUED)

Average Wages per Day	1954	1953	Increase	Decrease
Hourly employees				
Straight time-classified	15.72	14.82	.90	-
" " -incentive	21.48	20.13	1.35	-
Average	17.61	16.60	1.01	-
Holiday & vacation pay	1.54	1.22	.32	-
Overtime & shift diff.	.34	.54	-	.20
Total hourly employees	19.49	18.36	1.13	-
Average Wages per Month				
Hourly employees				
Straight time-classified	277.07	307.45	-	30.38
" " -incentive	378.86	423.94	-	45.08
Average	310.42	344.74	-	34.32
Fringe payments	33.18	19.18	14.00	-
Total hourly employees	343.60	363.92	-	20.32
Salaried employees	498.43	553.23	-	54.80
Avg.Days Worked per Mo.	17.42	20.83	-	3.41
Tons per Man per Day				
Surface	24.44	27.35	-	2.91
Underground	7.35	7.73	-	.38
Total	5.65	6.03	-	.38
Labor Cost per Ton				
Surface	.731	.615	.116	-
Underground	2.770	2.481	.289	-
Total	3.501	3.096	.405	-

7. SURFACE

The following major surface work was performed during 1954:

The office floor, which was badly rotted, was repaired and covered with linoleum.

All ties and decking were replaced on the enclosed coal dock.

During spring and fall, surveys were made of subsidence cracks, southwest of the shaft. The shop building continues to show signs of settlement along the west side.

Loading from the pockets was started on April 22. Because the Cambria-Jackson shovel was used for loading from the stockpile at the Lloyd Mine, it was necessary to rent a smaller shovel from a local contractor at a cost of 8¢ per ton, as compared to a cost of 4.4¢ per ton with the regular shovel. Only a small amount of ore (36,163 tons) was loaded out from stock and it was necessary to erect an additional trestle for stocking purposes, south of the main stocking area.

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8. UNDERGROUND

Shaft Sinking

There was no sinking carried on in the main shaft during 1954.

Shaft Maintenance

The vacation period during the last two weeks of July was utilized to replace 11 wooden shaft sets in the vicinity of the 6th level. The shaft has now been relined with steel sets from just above the 6th level to the bottom. In the vicinity of the 6th level pocket, the shaft timbers were so badly worn and pushed out of alignment that a considerable amount of reinforcement and blocking were necessary. The major portion of the shaft is composed of very old timbering, requiring constant attention to maintain in the best possible condition. An average of one repair shift per week is worked in the shaft.

General

All of the production was obtained from three areas, the west, central, and east deposits, with mining operations above and below the 7th level in the east deposit. In the west and central areas mining is approaching the bottom limits. The general effect of the curtailment was to temporarily decrease costs and increase production, inasmuch as it came at a time when a large amount of development work had just been completed. As areas were exhausted during this period, the mining contracts were able to move into previously developed areas. This condition continued until September, at which time it was necessary to resume the normal premining development work. The cost of mining development during this period dropped to an average of 49¢ per ton, as compared to a more normal average of 73¢ per ton for the remainder of the year.

A rather extensive program of exploration and development was carried out during the year, with 230' of diamond drilling and 2,250' of main level drifting completed. The cost of this work was not capitalized and was carried as part of the operating costs. At a cost of $40.00 per foot of drift and $8.00 per foot of drilling, the total cost was $91,840.00, or 38.6¢ per ton of ore produced. The diamond drilling was part of the program to explore the east deposit below the 7th level elevation. Of the main level drifting, 935' of drifting was done on the 8th level to further explore and develop the east deposit for mining purposes. Of this 8th level drifting 110' of ore was cut and 250' of ore was cut in the back of the drift, indicating that the drift elevation is at the best possible location for optimum mining conditions. It is too early, at this time, to make an accurate estimate as to the amount of ore made available by this drifting. Of the drifting on the 7th level, 910' of drift was for a bypass drift to replace the old main line which is caving due to the proximity of mining, and to make a pillar of ore above the 7th level available for mining. 405' of drifting was done in the east deposit for development and ventilation purposes. 210' of this drift cut ore.

Throughout the year a planned sequence of development and mining has been carried out as much as possible, and has been very effective in keeping the mining contracts in production. This is evidenced by the fact that only 14.3% of the contract time for the year was devoted to non-productive work.

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8. UNDERGROUND (CONTINUED)

General (Continued)

Ventilation of the mine is accomplished by taking air from the Mather Mine, A Shaft, 3rd level, and exhausting it through the various working places to the Cambria-Jackson shaft. A total of 54,663 cubic feet of air per minute is circulated through the workings, and is more than sufficient to provide maximum ventilation in all parts of the mine. The exhausted air is utilized to keep the shaft free from ice throughout the winter.

A study of the geology as development of the east deposit continued indicated a fault zone, not previously recognized, running NW-SE and dipping to the SW, from the Cambria fault to the ore-filled shear zones on the Mather Mine, B Shaft, 5th and 6th levels. This fault zone seems to be a definite ore-controlling feature. All of the important ore zones encountered below the Cambria-Jackson 6th level have been on the SW (downthrow) side of the fault zone, while all exploration of the upthrow side has failed to disclose any reserves, as illustrated by the development work in the ore cut by underground holes No. 208 and No. 209 above the 6th level, with only small unconnected pockets of ore existing in this area.

Development and Mining

As previously stated, the major development program for 1954 consisted of main level drifting. The development of the east deposit for mining above the No. 760 and No. 750 crosscuts on the 7th level was completed early in the year. This area was developed for the normal sublevel caving type of mining, as employed at the Cambria-Jackson Mine, with crosshauls normal to a main transfer drift. In practically all cases, mining operations were carried on adjacent to the several dikes which intersect the east deposit.

At the close of the year, mining in the west deposit had reached the bottom sublevel just above the 8th level, and it is quite evident that this west end will be exhausted early in 1955.

Mining was completed on the two top sublevels in the west end of the central deposit. At the close of the year the bottom sublevel, just above the 8th level elevation, was being developed for mining. In the east end of this deposit, the second sublevel above the 8th level was being developed for mining near the end of 1954.

With mining operations so close to the footwall, it is a very common occurrence to find the ore cut off by wild stringers of rock or dike, ranging from several feet in width up to 20 or 30 feet in width. To drive small drifts through this rock to determine the extent of the ore on the other side was very expensive. Early in the year a long-hole percussion machine, using extension drill rods, was introduced for the purpose of drilling test holes in these areas. Sludge samples are taken from each 5' run, and any change in drilling speed is noted. It has been found that these test-hole results can be plotted with a fair degree of accuracy, greatly helping the planning of mining and ore recovery. During the year, a total of 3,880' of test holes were drilled at a cost of approximately 52¢ per foot.

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8. UNDERGROUND (CONTINUED)

Diamond Drilling

The program for exploring the east deposit, below the 7th level elevation from the east end of the 7th level drift, was completed in February. Three holes were put down from this location, with 230' being drilled in 1954. As a result of this program, the eastward extension of the 8th level was started.

Brief logs of the holes drilled are listed below:

Hole No. 217

Footage	Material
0 to 6	- No core
6 to 35	- Rich hematitic cherty iron formation
35 to 75	- Normal hematitic cherty iron formation
75 to 90	- Rich hematitic cherty iron formation
90 to 103	- Ore
103 to 120	- Rich hematitic cherty iron formation
120 to 155	- Ore
155 to 180	- Rich hematitic cherty iron formation
180 to 185	- Ore
185 to 200	- Rich hematitic cherty iron formation
200 to 201	- Intrusive
201 to 280	- Ore
280 to 321	- Normal hematitic argillaceous cherty iron form.
321 to 333	- Argillite

Location	Dip	Course	Elevation	Started	Completed
7L.S526.33&9198.37W.	-26°00'.	N00°47'E.	-95.37'.	11-17-53.	1-5-54.

Hole No. 218

Footage	Material
0 to 93	- Rich hematitic cherty iron formation
93 to 98	- Normal hematitic Goethitic cherty iron formation

Location	Dip	Elevation	Started	Completed
7L.S529.20&9196.83W.	-90°00'.	-95.89'.	1-6-54.	1-13-54.

Hole No. 219

Footage	Material
0 to 90	- Rich hematitic cherty iron formation
90 to 130	- Ore
130 to 132	- Lean hematitic cherty iron formation

Location	Dip	Course	Elevation	Started	Completed
7L.S524.02&9198.33W.	-56°00'.	N1°15'W.	-95.62'.	1-13-54.	1-28-54.

Statement of Timber Used

	Lineal Feet		Average Price per Foot	
	1954	1953	1954	1953
Stulls	31,337	40,457	.2155	.2245
Square Cribbing	4,136	14,332	.1390	.0912
Round Cribbing	5,888	35,711	.1190	.0874
Lagging	345,265	693,990	.0201	.0200
Poles	173,163	197,521	.0383	.0380
Steel H-Beams	12,556	1,576	.9314	.9218
Total Cost per Ton			.140	.104

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8. UNDERGROUND (CONTINUED)

Statement of Timber Used (Continued)

The amount of timber used underground was less than was used in 1953, due primarily to the smaller operation that was effected by the curtailment. However, the use of steel H-beams used was substantially more than the previous year due, in most part, to the fact that 89% of the drifting done during the year was in ground that required support.

Explosives

	Quantity	Average Price	Amount 1954	Amount 1953
Gelamite #1X - Lbs.	60,300	.1750	10,552.37	7,269.82
Hercomite #2X - Lbs.	100,750	.1673	16,852.91	28,007.22
Gelatin 5x5 60% - Lbs.				798.75
Gelatin 4x2 60% - Lbs.	6,950	.2375	1,650.65	1,899.27
Total Powder	168,000	.1730	29,055.93	37,975.06
Fuse, Caps, Etc.			6,658.10	9,537.53
Tot. Expls., Development and Mining			35,714.03	47,512.59
Average Price per Pound for Powder			.1730	.1720
Pounds of Powder per Ton of Ore			.707	.629

Pumping

The average G. P. M. pumped during the year was 327, as compared with 348 in 1953. These totals are directly proportional to the climatic conditions throughout the year. The peak pumping period occurred in May with 511 G. P. M., as compared with the peak in July, 1953, of 499 G. P. M. All pumping equipment has been maintained in good condition, and all sumps were cleaned at least once during the year.

9. TAXES

Cambria Realty	1954 Valuation	1954 Taxes	1953 Valuation	1953 Taxes
S½ of SE¼ of Sec. 35, 48-27) Lots 7&8 of Sec. 35, 48-27) Lots 5,6&7 of Sec.36, 48-27) - 222.09 Acres)	200,000	8,896.00	200,000	9,270.00
Jackson Strip N660' of N½ of NW¼ of Sec.1) 47-27 - 40 Acres)	300,000	13,344.00	590,000	27,346.50
Personal Property				
Stockpiles, Supplies & Equip.	300,000	13,344.00	300,000	13,905.00
Tot.by Mich.State Tax Com.	800,000	35,584.00	1,090,000	50,521.50
Collection Fee		355.84		505.22
Total Taxes, Negaunee	800,000	35,939.84	1,090,000	51,026.72
Division of Payments				
Cambria-Jackson Taxes,Ishp.*	100,000	3,895.00	100,000	3,895.00
Cambria-Jackson Taxes,Neg.	800,000	35,939.84	1,090,000	51,026.72
TOTAL	900,000	39,834.84	1,190,000	54,921.72

*Cambria-Jackson Mine-Ishpeming
N660' of NE¼ of NE¼ of Sec.2)
47-27 - 20 Acres)

Tax Rate per $100 of Valuation	1954	1953
City of Negaunee	4.448	4.635
City of Ishpeming	3.895	3.895

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10. ACCIDENTS AND PERSONAL INJURY

The accident and personal injury record was excellent for 1954. According to safety department figures, the Cambria-Jackson Mine was accorded the number one position rating for the Company underground properties, as compared to the number five position rating in 1953.

Accident statistics and details of all accidents are listed below:

Year	Number of Compensable Accidents	Days Lost All Injuries	Frequency	Severity
1954	1	31	12.39	.096
1953	7	345	22.22	.767

Acc. No.	Date of Accident	Name	Injury	Days Lost
103	2-19-54	Nick E. Olgren	Severe laceration of head	22

11. POWER

As a result of the general change in power distribution, sales, and supply from the subsidiary utility company to a Cleveland-Cliffs department, there was a sharp reduction in the cost of electric power, as shown below:

Year	K. W. H.	Cost	Rate
1954	3,792,000	36,496.51	.0096
1953	4,579,200	78,251.09	.0171

MAAS MINE
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1. GENERAL

The Maas Mine operated on a 5 day, 2 shift schedule from January 1st to April 5th, 1954. On April 5, the schedule was reduced to 4 days per week. On both schedules there was a smaller crew of trammers and some miners on the third shift to keep production up and tram ore which accumulated on the preceding two shifts. Some miners were placed on the third shift due to a shortage of working places that developed when the 6th level area was abandoned due to excessive repairs necessary to maintain the long drift along the north footwall area.

On May 16th the labor force was reduced by approximately 25%, resulting in 81 men being laid off. This curtailment was necessary in order to reduce ore inventories carried into next year. There was also an additional loss of 6 employees due to normal separations, making a total loss for the year of 87. Effective July 1, the C.I.O. negotiated a five cent per hour increase which was paid to the hourly men. The insurance agreement was also opened on November 1, but the final settlement was not forthcoming until after the year end.

The total production for the year amounted to 401,117 tons. This, of course, is much lower than the year previous due to less demand for ore, resulting in reduction of men and working schedule. The average grade on output was held to within the allowable limits. There has been a significant change in grade as the producing areas move lower and to the west. The average sulphur analysis, based on shipments, has risen from .168% in 1953 to .258% in 1954. Also, the silica analysis has been reduced from 9.38% in 1953 to 8.36% in 1954 without a proportionate increase in iron content. The iron actually went up only .15%.

Main level development work was concentrated on the 6th and 7th levels with the major portion on 7th level. Considerable rock development was done on 6th and 7th levels for the proposed conveyor system, which was laid out to replace the winze. However, late in the year this work was stopped when it was decided to consolidate the Maas and Bunker Hill mines. All hoisting will be done thru the Bunker Hill shaft. Additional development was also done to the west where the north footwall drift was extended to the 3000' coordinate. Diamond drill stations were cut along this drift and a drilling program was started to delineate the ore body in the Pioneer and Arctic property.

The drilling program, which was started late in 1953, was continued until June. In general, the ore outline was approximately the same as in preceding sections in the Maas. However, the section to the south in Pioneer and Arctic did not prove up as expected earlier and consequently, the prospective reserves were reduced.

MAAS MINE
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2. PRODUCTION

a. Production by Grades and Months

Month	Maas	Race Course	Total	Rock
January	41,665	5,231	46,896	1,465
February	42,101	3,653	45,754	2,125
March	45,154	9,598	54,752	1,495
April	35,530	7,468	42,998	1,160
May	28,794	2,107	30,901	1,300
June	28,594	3,461	32,055	3,525
July	12,059	1,191	13,250	3,405
August	22,860	963	23,823	1,920
September	26,340	1,240	27,580	2,965
October	24,046	3,484	27,530	2,555
November	21,540	4,324	25,864	2,855
December	24,114	5,600	29,714	1,655
Total	352,797	48,320	401,117	26,425
Stockpile Overrun	—	—	—	—
Grand Total	352,797	48,320	401,117	26,425

The Product was distributed by Leases as follows:

	1954	1953
George Maas Lease	339,802	466,756
Race Course Lease	48,320	98,643
Baldwin Kiln Road	12,995	21,617
Total Ore	401,117	587,016
Rock	26,425	25,345
Total Hoist	427,542	612,361

b. Shipments

Grade of Ore	Pocket Tons	Stockpile Tons	Total Tons	Total Last Year
Maas	57,252	103,237	160,489	450,518
Race Course	5,900	- -	5,900	111,581
Total	63,152	103,237	166,389	562,099
Total Last Year	268,431	293,668	562,099	- -
Increase Decrease	205,279	190,431	395,710	

MAAS MINE
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2. PRODUCTION - Continued

c. Ore Statement

	Maas	Race Course	Total	Total Last Year
On Hand 1-1-54	93,555	6,487	100,042	75,125
Product for Year	352,797	48,320	401,117	555,851
Overrun	- - -	- - -	- - -	31,165
Total	446,352	54,807	501,159	662,141
Shipments	160,489	5,900	166,389	562,099
Balance on Hand	285,863	48,907	334,770	100,042
Increase in Output				
Decrease in Output	108,113	46,621	154,734	

Schedule of Operations 1950 - 54

Days	Shifts	Hours	
5	2	8	1-1-50 to 8-26-50
6	2	8	8-26-50 to 5-18-52
5½	2	8	5-19-52 to 11-16-52
5	2	8	11-17-52 to 4- 4-54
4	2	8	4- 5-54 to 12-31-54

d. Division of Product by Levels

	1954	%	1953	%
Fourth Level	53,405	13.3	133,087	22.7
Fifth Level	32,122	8.0	47,429	8.1
Sixth Level	142,443	35.5	320,626	54.6
Seventh Level	173,147	43.2	85,874	14.6
Total	401,117	100.0	587,016	100.0

e. Production Delays

	Tons Lost
Feb. 18 - winze hoist shafting sheared	700
Mar. 15 - cage jammed in main shaft	600
Dec. 9 - cage jammed in winze	400
Dec. 21 - cars fell down winze	400
Total Loss	2,100 tons